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Volume 4

Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR)

User's Guide

Part 2: Guide to Operations

COMPLETED

Prepared by W.E. Gilmore, C.D. Gentillon, D.I. Gertman,
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EG&G Idaho, Inc.

Prepared for
U.S. Nuclear Regulatory
Commission

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ABSTRACT

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal micro-computer. NUCLARR can be used by the end user to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment activities.

The NUCLARR system is documented in a five-volume series of reports. Volume IV of this series is the User's Guide for operating the NUCLARR software and is presented in three parts. Part 1: Overview of NUCLARR Data Retrieval provides an introductory overview to the system's capabilities and procedures for data retrieval. The methods and criteria for selection of data sources and entering them into the NUCLARR system are also described in this document. Part 2: Guide to Operations contains the instructions and basic procedures for using the NUCLARR software. Part 2 provides guidance and information for getting started, performing the desired functions, and making the most efficient use of the system's features. Part 3: NUCLARR System Description provides an in-depth discussion of the design characteristics and special features of the NUCLARR software. Part 3 presents the organization of the data base structures and techniques used to manipulate the data.

It is recommended that the new user first become acquainted with Part 1 in order to get an overview of the NUCLARR system. Then, familiarity with Part 2 for operating the software is recommended. Access to Part 3 should be obtained if the user is interested in learning more about the internal aspects of the NUCLARR software functions and capabilities.

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SUMMARY

The Nuclear Computerized Library for assessing Reactor Reliability (NUCLARR) is documented in a series of five volumes. Volume I: Summary Description is a general overview of the NUCLARR system. Volume I provides the background of the NUCLARR program, including a description of methods for data collection, system specification, data structures, and taxonomies. Volume II: Programmer's Guide provides information for maintaining the software for the NUCLARR system. Volume III: Data Base Management Guide for Processing Data and Revising the Data Manual contains the procedures for processing human error probability and hardware component failure data and entering the data values into the NUCLARR system. Volume IV: User's Guide instructs the end user in operating the NUCLARR software. Volume V: Data Manual is a hard-copy report of the data residing in the NUCLARR system.

Volume IV is presented in three parts for the convenience of the user. Part 1: Overview of NUCLARR Data Retrieval describes the scope of the NUCLARR system, support organizations, methodologies for screening data sources for entry, and guidance for usering Parts 2 and 3. This volume, Part 2: Guide to Operations, tells the end user how to get started and walks through the mechanics for performing data base operations (e.g., file management, data aggregations, search and retrieval of data). Part 3: NUCLARR System Description describes in detail the organization and special features of the NUCLARR software, including an explanation of the methods for data aggregations and calculations.

Information for obtaining the NUCLARR software and/or documentation should be directed to:

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ACRONYMS

AI	artificial intelligence
B&W	Babcock and Wilcox Company
CE	Combustion Engineering, Inc.
GE	General Electric Company
HEP	human error probability
HCFB	hardware component failure data
HHRAG	Human and Hardware Reliability Analysis Group
HRA	human reliability analysis
INEL	Idaho National Engineering Laboratory
IRADAP	Integrated Risk Assessment Data Acquisition Program
IRRAS	Integrated Reliability and Risk Analysis System
NRC	U.S. Nuclear Regulatory Commission
NSSS	nuclear steam supply system
NUCLARR	Nuclear Computerized Library for Assessing Reactor Reliability
PC	personal computer
PRA	probabilistic risk assessment
PSF	performance shaping factors
RC	recovery considered
RNC	recovery not considered
SARA	Systems Analysis and Risk Assessment System
West	Westinghouse Electric Corp.

NUCLEAR COMPUTERIZED LIBRARY FOR ASSESSING REACTOR RELIABILITY (NUCLARR)
VOLUME IV: USER'S GUIDE
PART 2: GUIDE TO OPERATIONS

1. INTRODUCTION

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system used to process, store, and retrieve human and hardware reliability data in a ready-to-use format. The NUCLARR system was developed by the U.S. Nuclear Regulatory Commission (NRC) to provide the risk analysis community a repository of data that can be used to support a variety of risk assessment activities. The system maintains a broad range of data base management functions for storing, processing, and retrieving human error and hardware component failure rate data. Computational algorithms for aggregating the source data and routines for report generation are also provided. The system software, designed for operation on an IBM[a] personal computer (PC) (or PC compatible) microcomputer, is readily transportable to a wide range of users.

The equipment taxonomies and data structures for NUCLARR were designed specifically to support probabilistic risk assessment (PRA) techniques currently used by the nuclear power industry. The NUCLARR system aids the risk analysis process by providing the analyst with accurate and relevant data from an on-line data base. This computerized capability gives the analyst a powerful device to search and retrieve data in a timely fashion. The former drudgery of reviewing multiple hard-copy documents to obtain useful data has now been eliminated with the availability of NUCLARR.

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a. Mention of specific products and/or manufacturers in this document implies neither endorsement or preference nor disapproval by the U.S. Government, any of its agencies, or EG&G Idaho, Inc., of the use of a specific product for any purpose.

However, the capabilities of NUCLARR as a compact, transportable, and functional PRA workstation should also be contrasted with what it is not. For example, NUCLARR is not an artificial intelligence (AI)/expert system. It is assumed that the analyst must bring some prior skills and knowledge to bear in order to make effective utilization of this tool. In this regard, NUCLARR can best be classified as a library and not a chief librarian. The concept of furnishing analysts with a highly mechanistic or "cook book" approach for data usage was ruled out in exchange for a system that would be both flexible and comprehensive for adapting to a wide diversity of applications. It was also determined, at the onset, that NUCLARR would not provide the capability to construct fault trees or core melt frequencies. Other tools already exist that provide these functions, and it was felt that NUCLARR could better support the risk analyst by supplying the data inputs to these other products. The Integrated Reliability and Risk Analysis System (IRRAS) and Systems Analysis and Risk Assessment System (SARA) are two such products, developed under NRC sponsorship, that provide the capabilities for higher-order model development and analysis.[1,2] Future development efforts at the Idaho National Engineering Laboratory (INEL) will focus on devising more effective ways to interface NUCLARR, as a supplier of source data, to support these other programs.

In summary, the present version of NUCLARR, as described in this manual, provides the experienced user (e.g., PRA analyst) with an important computer-based support capability for conducting risk analysis. Very little, if any, training is required before the analyst is able to access human error probability (HEP) and hardware component failure data (HCFD).

The purpose of this three-part document is to provide the end user with a detailed description of the NUCLARR data management system, including instructions for accessing and retrieving specific data. To that end, an overview of the NUCLARR system is given in Part 1. Parts 2 and 3 of this document provide, respectively, a guide to operations (including examples) and a detailed system description that defines all attributes of the data being stored, describes the way in which these data are stored, and describes computations performed by the NUCLARR system.

2. INSTALLATION AND GETTING STARTED

This document (Part 2) describes how an analyst, PRA or otherwise, should use the search and retrieval capabilities in order to review and/or summarize the HEP and HCFD residing in the NUCLARR system. The capabilities and special functions for operating the HEP and HCFD sides of the system to be discussed are presented below:

- Getting Started--Software Set-Up Procedure
- Command/Menu Preview
- Glossary of Frequently Used Commands
- On Line HELP
- Data Search and Retrieval Techniques: Using the Descriptive Search
- Data Search and Retrieval Techniques: Using the Ad Hoc Search
- File/Buffer Management
- Data Aggregations
- Data Output and Report Generation
- Graphic Plot Routines
- Strategies for Reviewing Data Records to Determine their Applicability
- Document File/Source Catalog
- Practice and Review: Tutorial

Prior to interacting with the NUCLARR system, it is strongly suggested that first-time users gain familiarity with Section 3, Command/Menu Preview; Section 4, Glossary of Frequently Used Commands; and Section 5, On-Line HELP. A working knowledge of these areas, as a minimum, is a prerequisite for successful system operation.

The checklist in Table 1 provides the minimum system configuration requirements for operating the NUCLARR programs. Any questions should be referred to the NUCLARR Data Clearinghouse.

TABLE 1. NUCLARR SYSTEM MINIMUM CONFIGURATION REQUIREMENTS CHECKLIST

(1) IBM-PC or PC compatible (IBM-PC/AT or IBM System-2 preferred)

(2) Minimum of 640 K-bytes memory

NOTE: Available memory can be checked by typing the following command: CHKDSK

The last two lines of the output statement should display numbers similar to:

655360 bytes total memory
602144 bytes free

NOTE: This memory requirement must be available for NUCLARR system operation. Memory resident programs such as Boreland Side-Kick should be unloaded before putting NUCLARR on your PC. Failure to do so can result in stack overflow and other memory problems. Virtual disk commands and the IBM Sys. CACHE file on PS/2 will cause stack overflow problems.

(3) Math coprocessor (8087 floating point card)

(4) Configuration file should read:

```
device=ansi.sys
files=20
buffers=15
lastdrive=Z
```

NOTE: Configuration file can be checked by typing the following command: TYPE C: CONFIG.SYS. If it doesn't read as above, consult your DOS manual on how to edit it.

(5) Graphics card (enhanced graphics card preferred)

(6) Color monitor adapted for full use of 16 colors

NOTE: Monochrome monitor is acceptable, but not recommended. The lack of color will result in significantly reduced resolution quality.

(7) 20-megabyte hard disk minimum (30-megabyte hard disk preferred)

(8) Floppy disk drive

(9) DOS operating system (3.0, 3.1, 3.2, or 3.3)

2.1 Installation Instructions

The NUCLARR data base consists of two parts: HCFD and HEP data. The installation procedure attempts to define the directories HEP, HARDWARE, HALO, and NUCLARR at the root level of Drive C:. If these directories have already been created, you will receive the error message Unable to create directory. This is not a problem and may be ignored. Drive C: must be on the hard disk. If your system has a different configuration, call the Data Clearinghouse for help.

The NUCLARR diskettes include the installation diskette, which is marked Installation Diskette, and the data diskettes, which are marked NUCLARR Data Diskette ## of ##. The installation procedure is set up to read the diskettes from drive A: and is simple:

1. Insert the installation diskette into drive A.

2. Type

```
A:INSTALL <ENTER>
```

After typing the above command, additional instructions will be displayed on the computer's monitor. The installation procedure will execute, asking you to remove the NUCLARR data diskettes in numerical order.

2.2 Getting Started

In order to run the NUCLARR retrieval program, type the following command:

```
C: >NUCLARR <ENTER>
```

After typing in the above command, the menu shown in Figure 1 will be displayed.

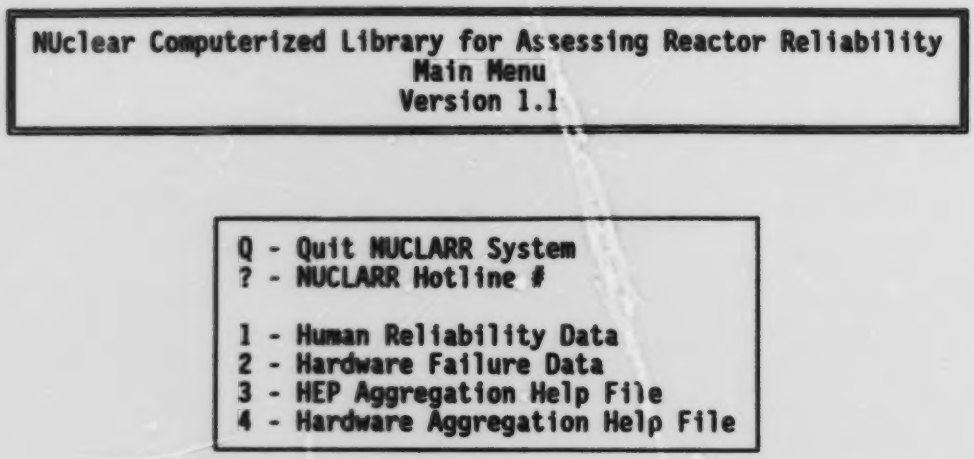
NUclear Computerized Library for Assessing Reactor Reliability
Main Menu
Version 1.1
Q - Quit NUCLARR System
? - NUCLARR Hotline #
1 - Human Reliability Data
2 - Hardware Failure Data
3 - HEP Aggregation Help File
4 - Hardware Aggregation Help File

Figure 1. Menu for selecting the HEP or hardware side of the NUCLARR system.

3. COMMAND/MENU PREVIEW

The NUCLARR system makes use of a menu and command options structure, allowing the user maximum flexibility to locate, review, and manipulate data records. After making a selection from the master menu for HEP or HCFD, one or more primary or main menus will be displayed to the user. Main menu glossaries of the available options for the HEP and HCFD sides are shown in Tables 2 and 3, respectively.

Several methods are available for selecting options from the NUCLARR menu screens. The primary approach is accomplished with the use of the space bar or tab/arrow keys. The option selected is highlighted to the user by a different background color. An alternative approach for selecting menu options consists of entering the option number directly from the keyboard. Whenever the number of selectable menu options exceeds the number of lines on a screen, the Pg Up and Pg Dn keys can be used to scroll through the list. As the user moves down through the menu structure, a record indicating the options selected is continuously stored and displayed in the header block at the top of the menu screen. This header information supplies the user with a roadmap of where he/she has been, and where he/she is going in the search structure. At any point within the menu hierarchy, it is possible to exit or escape back to the previous menu or, alternately, back to the main menu. Table 2 presents a single menu for processing HEP data. Table 3 presents one main menu followed by two primary menus. The types of options available for both types of data are similar, however, as a comparison of these tables shows.

The menu scheme, within the context of the NUCLARR system, provides the means for highly structured, or descriptive searches for data. These user-friendly menus mimic the hierarchical structure of the taxonomies for both HCFD and HEP data.

In addition to the basic menu dialog for locating data, the user can also initiate data searches using an ad hoc search mode. The ad hoc feature removes the need to step through individual menus by providing the

TABLE 2. MAIN MENU GLOSSARY OF OPTIONS--HEP

HEP Menu/Name Option	Description
Main Retrieve Menu	
E - Exit from HEP Retrieve Program	Exit to the NUCLARR main menu. All located data record references are cleared from the storage buffer.
? - NUCLARR Hotline #	Display the Data Clearinghouse number for information concerning the data or the utilization of NUCLARR.
1 - Locate HEP Data Records by Description	Locate NUCLARR data records by using a series of user-friendly menus. The search buffer holds references to located records.
2 - Review Documents	Review source documents noted in source statements as original and reference documents. A report option and a search of all references to a document are available.
3 - Locate HEP Data Records by Ad Hoc Search	Locate NUCLARR data records by ad hoc search method. The search buffer holds references to located records.
4 - Report on Located HEP Data Records	Report on the screen, printer, or to a file all located data records currently referenced in the search buffer.
5 - Plot from Located HEP Data Records	View log plots of aggregated probabilities and source data points.
6 - Calculate Aggregated HEP for Located Records	Combine HEPs for homogeneous located records, currently referenced in the search buffer, to determine an aggregated HEP value with confidence bounds.
7 - Generate ASCII File for dBase III/SAS/SPSS	Generate an ASCII file in a format compatible with the dBase III, SAS, and SPSS systems. Source statements are converted for all located data records or for all data in the data base. For the dBase III system, task statements and documents may also be converted.

TABLE 2. (CONTINUED)

HEP Menu/Name Option	Description
Main Retrieve Menu (continued)	
8 - Retrieve a Saved Data Records File	A previously saved search file may be requested and brought into memory for modifying, reporting, aggregating, and ASCII file generation. Such a file must have been created by option 9 of this main menu.
9 - Save Located Data Records to a File	Copy records currently in the search buffer (for located records) out to a disk file named by the user. If the named file currently exists, it will be overwritten with the data passed to it through this option.

TABLE 3. MAIN MENU GLOSSARY OF OPTIONS--HCFD

HCFD Menu/Name Option	Description
Main Retrieve Menu	
E - Exit from Hardware Retrieve Program	Exit to the NUCLARR main menu. All previously located data record references are cleared from the search buffer.
? - NUCLARR Hotline #	Display the Data Clearinghouse number for information concerning the data or utilization of NUCLARR.
1 - Locate Data Records by Description	This option allows the selection of HCFD data records by description of component category, component, design, etc. The selection of key fields follows the HCFD failure taxonomy, beginning with a screen requesting category selection, i.e., the selection of mechanical or electrical components. Upon selection of one category option, selection of components types belonging to the selected category occurs. Each component type will be displayed with code, number of representative data records in the data base, and complete description. Selection proceeds for component design, failure mode, normal state, and application in a similar manner, with each selection narrowing the set of data records being collected and searched. The resulting data records are placed in the "search buffer" for viewing, further elimination, aggregation, reporting, plotting, etc. The search buffer may be saved on disk for future use, if desired.
2 - Locate Data Records by Ad Hoc Search	This option allows quick retrieval of HCFD data records using a single screen requesting the user for codes and key data values which describe the desired source records. Upon entry to the ad hoc screen, only a component code must be entered to initiate a search. If the code of the desired component, or other source attribute, is unknown, complete code and description lists are available with the press of the <Esc> key. On the ad hoc screen, ONLY FIELDS WHERE SPECIFIC DATA ARE DESIRED REQUIRE AN ENTRY. A BLANK FIELD IMPLIES

TABLE 3. (CONTINUED)

HCFD Menu/Name Option	Description
Main Retrieve Menu (continued)	
2 - Locate Data Records by Ad Hoc Search (continued)	"ALL," THAT IS, ALL DATA RECORDS FOR THE SELECTED COMPONENT WILL BE CONSIDERED IN THE SEARCH. When the desired fields have been filled, the search may commence. If records are found, the search buffer is loaded and the search buffer options may be executed.
3 - Review Documents	Review the documents residing in the HCFD data base. A report option and a search of all documents are available.
4 - Hardware Glossary of Terms	This option allows the reviewing of the HCFD section of the NUCLARR glossary. All terms and notation used in the HCFD retrieve menus, selection screens, and help screens are listed with detailed definitions. A copy of the glossary may be printed or put to a file if desired.
Descriptive Search of Hardware Data Main Menu	
E - Exit from Descriptive Search Program	Exit to main HCFD retrieve menu. User will be reminded to save any existing search results not already saved by option No. 8 below.
? - NUCLARR Hotline #	Display Data Clearinghouse telephone number.
1 - Retrieve a Saved Data Records File	A previously saved search file may be requested and brought into memory for modifying, reporting, aggregating, and ASCII file generation. Such a file must have been created by option 9 of this menu.
2 - Begin Descriptive Search	Begin the descriptive search function which displays descriptions of all components, designs, failures, normal states, applications, etc., following the taxonomy described in EGG-REQ-7742.[3] Selections may be made at each taxonomy level, thus narrowing the number of source records to be searched as each taxonomy level is descended.

TABLE 3. (CONTINUED)

HCFD Menu/Name Option	Description
Descriptive Search of Hardware Data Main Menu (continued)	
3 - "Tailored" Selection and Aggregation	Extend the descriptive search option 2 or file option 1 with a quick selection screen for failure data origin; domestic or foreign, nuclear or non-nuclear, safety or non-safety grade, and quality-coded data fields. This function will complete the selection, aggregate, and display the aggregated events and selected source records.
4 - View the Located Data Records	View the source records currently in the buffer and all associated event aggregations. If the aggregation option has not yet been selected, auto aggregation values from the data base will be displayed.
5 - Aggregate Probabilities for located records	Compute aggregated probabilities or rates using the source data currently referenced in the search buffer.
6 - Report on Located Data Records	Report on the screen, printer, or to a file all events and data sources currently referenced in the search buffer.
7 - Plot from Located Data Records	View log plots of aggregated probabilities or rates and source data points.
8 - Generate ASCII File for dBase III/SAS/SPSS	Generate and save an ASCII file of aggregated event probabilities or rates suitable for use by dBase III or in SAS and SPSS programs.
9 - Save Located Data records to a file	Copy records currently in the search buffer (located records) to a disk file named by the user. If the named file currently exists, it will be overwritten with the data passed to it through this option.
Ad Hoc Search of Hardware Data Main Menu	
E - Exit from Ad Hoc Search Program	Exit to main HCFD retrieve menu. User will be reminded to save any existing search results not already saved by option 8 below.

TABLE 3. (CONTINUED)

NCFD Menu/Name Option	Description
Ad Hoc Search of Hardware Data Main Menu (continued)	
? - NUCLARR Hotline #	Display Data Clearinghouse telephone number.
1 - Retrieve a Saved Data Records File	A previously saved search file may be requested and brought into memory for modifying, reporting, aggregating, and ASCII file generation. Such a file must have been created by option 8 of this menu.
2 - Ad Hoc Search	Begin the ad hoc search function which will display a series of screens on which specific values may be selected to initiate a search of the NCFD source data.
3 - View the Located Data Records	View the source records currently in the buffer and all associated event aggregations. If the aggregation option has not yet been selected, auto aggregation values from the data base will be displayed.
4 - Aggregate Probabilities for Located Records	Compute probabilities or rates of the aggregated NCFD source data currently referenced in the search buffer.
5 - Report on Located Data Records	Report on the screen, printer, or to a file all events and data sources currently referenced in the search buffer.
6 - Plot from Located Data Records	View log plots for the display of aggregated probabilities or rates and source data points.
7 - Generate ASCII File for dBase III/SAS/SPSS	Generate and save an ASCII file of aggregated event probabilities or rates suitable for use by dBase III or in SAS and SPSS programs.
8 - Save Located Data Records to a File	Copy records currently in the search buffer (located records) out to a disk file named by the user.

user the means to pick the desired characteristics of a data set from several parameters displayed on a single screen. Instead of locating records using a single unique search criterion, as defined from a menu search, the ad hoc mode locates subsets of data from a broad variety of user-selectable parameters. A typical search in the ad hoc mode consists of entering either an alphanumeric code or an X in the designated fields for each desired parameter to define the criteria for which the search is to be performed. There is no limit, in ad hoc, to the number or type of searches available to the user in this mode. The flexibility of ad hoc search can range from a broad to a highly restricted set of data.

It is expected that the user interested in finding a data value at a known or predictable location within the taxonomy would initiate a descriptive search with the menuing system. In cases where the user is looking for larger sets of data, based on assorted parameters, then an ad hoc mode search, using a pick-and-choose strategy, would be performed. The first-time user of the system may find it easier to become acquainted with the descriptive search, since only the movement of the cursor through a menu is needed for performing a search, whereas in ad hoc the ability to enter one or more codes is required.

Regardless of the search mode selected (i.e., descriptive or ad hoc), the user still retains the same options for performing any number of follow up operations furnished by the NUCLARR system. (A more comprehensive description of the menu, or descriptive search mode, as well as the ad hoc feature of the NUCLARR system, is presented in Sections 6 and 7.)

Once data have been located by the user, a command option line is normally displayed at the bottom of the screen for the ad hoc search mode and a special buffer options menu is displayed for the descriptive search mode. This provides the user added capability, as needed, to perform specialized operations on the located data.

Typically, the valid command options available are listed in the command line and can be executed with a single keystroke (e.g., select

<A> for <A>ggregation). If additional clarification is needed regarding the uses for certain commands, a detailed explanation is provided in the general HELP screens. It should be noted that not all acceptable commands will be displayed on the screen. There are other special command sets, useful to the user for different applications that are not always displayed. For example, pressing <F10> is an alternate way to move out of a HELP screen. In order to familiarize the user with the full range of the most frequently used command options available, a glossary is presented in the next section.

4. GLOSSARY OF FREQUENTLY USED COMMANDS

The NUCLARR user will be prompted for information throughout program execution. Screens will be displayed allowing the user to input several pieces of information simultaneously. Full screens or windows will appear with various questions. Each of these questions corresponds to an associated entry field.

Each entry field is set up so that only the valid key may be entered. If an invalid entry is made, a bell will ring and/or an error message will be displayed; afterward, a valid entry may be entered.

The cursor will often be placed at a predetermined location on the screen by the program. After an entry is made in the field, the cursor will move to the next field. To move the cursor to other fields, the <Tab> key or the arrow keys may be used. Pressing the <Home> key will return the cursor to the command field.

In order to aid the user with the retrieval of information, the following keys have been defined:[a]

<Alt><H>--Pressing both keys simultaneously will activate the on-line help facility that describes cursor functions.

<Arrows>--The arrow keys will move the cursor around the screen.

<Ctrl><End>--After using the arrow keys to left-justify the cursor, pressing <Ctrl> and <End> simultaneously will clear the current field.

---

a. Note that the <|←—/—→|> key and the <Tab> key are interchangeable. Depending on the machine being used, the keyboard may indicate a tab function as a <Tab> or <|←—/—→|>.

<Ctrl><Home>--Pressing both keys simultaneously clears all entry fields on the current screen.

<Enter>--Pressing the <Enter> key throughout NUCLARR signals the program to continue. It will execute the command selected on the menu. All information should be entered in the appropriate fields prior to pressing the <Enter> key.

<Esc>--Pressing <Esc> provides on-line help information. At any time during interaction with NUCLARR, press the <Esc> key for help. Help information will be displayed that pertains to the field in which the cursor is located or information about the entire menu.

--Pressing this key moves the cursor forward around the screen to the various entry fields.

<Shift> --Pressing both keys simultaneously moves the cursor backwards around the screen to the various entry fields.

<PgUp> and <PgDn>--Pressing these keys scrolls up and down through a multipage list of menu options.

<Home>--puts the cursor into the COMMAND field. Particularly useful for the ad hoc search screen.

<F10>--Press this key to exit from the HELP screens.

The commands listed below will help the user during the execution of the NUCLARR system.

<A>ggregate--typed in the COMMAND field aggregates the records currently residing in the buffer.

<E>xit--typed in the COMMAND field will exit from the current menu.

<L>ocate--typed in the COMMAND field locates the requested records and places them in the buffer. (See also <N>ext and <P>revious.)

<N>ext--typed in the COMMAND field locates the next available record after the existing record displayed on the screen. (Used after invoking the <V>iew option.)

<P>revious-typed in the COMMAND field locates the previous record before the existing record displayed on the screen. (Used after invoking the <V>iew option.)

<R>eport--typed in the COMMAND field generates a hard copy report of the located records.

<?>--typed in the COMMAND field displays the phone number for the NUCLARR Data Clearinghouse for further system information.

<M>ore data--typed in the COMMAND field will step down to a more detailed presentation of the data.

<U>nselect--typed in the COMMAND field removes the displayed record from the buffer. (Used after invoking the <V>iew option.)

<S>tart--typed in the COMMAND field executes report generation routines to the designated output device (printer, console, file).

<C>lear Total--typed in the COMMAND field clears the selected records from the holding buffer. This option allows for a new search without consideration of the records already in the buffer from a previous selection.

<V>iew Data--Typed in the COMMAND field selection of this option displays the data records selected and in the buffer.

5. ON-LINE HELP

The NUCLARR system makes extensive use of embedded HELP screens. In most places throughout the system, HELP screens can be accessed by pressing the escape key. The HELP screens are logically organized within the NUCLARR system according to the structure of the user architecture. Only HELP screens relevant to the task being performed at a perspective location in the system can be accessed. For example, in the HEP side, HELP on PSFs cannot be viewed if the user is selecting options from the main menu. HELP information on a certain aspect of a screen can be accessed by first moving the cursor to the specific field or location of interest, then pressing <Escape>. The HELP features of the NUCLARR system are perhaps the most beneficial to the user while operating in the ad hoc search mode. At any point in the ad hoc search screen, clarification as to the meaning of a particular parameter can be obtained with the use of the HELP option. While in the ad hoc mode, code lists can also be accessed using HELP. Once the code list has been accessed, the actual code can be picked from the help screen and placed in the applicable field on the ad hoc search screen by following the instructions on the HELP screen. Thus the need to recall long lists of codes is eliminated.

6. DATA SEARCH AND RETRIEVAL TECHNIQUES: USING THE DESCRIPTIVE SEARCH

User-initiated descriptive searches for both the HCFD and HEP sides of the NUCLARR system are menu-driven. The user follows the menus through the taxonomy in an iterative fashion in order to arrive at the particular data record(s) of interest. Due to the unique design of the HEP and HCFD taxonomies, the procedures for performing a descriptive search will be presented separately.

6.1 Human Error Probability

A flow chart depicting the organizational structure of the menu/commands for the descriptive search mode for HEP is shown in Figure 2. The individual steps required for performing a descriptive search are summarized below.

Step 1 -- Select taxonomy level (Level 1--system; Level 2--component; or Level 3--individual display). This describes the equipment affected by the human error.

Step 2 -- Select job classification (not applicable if Level 3 is selected)

Step 3 -- Select NSSS vendor (not applicable if Level 2 or 3 is selected)

Step 4 -- Select functional group summary for equipment group

Step 5 -- If desired, select specific equipment group

Step 6 -- Select human action

Step 7 -- Select data display option (i.e., screen, file, printer)

A glossary of the individual descriptive search menus and their options for HEP data is presented in Table 4.

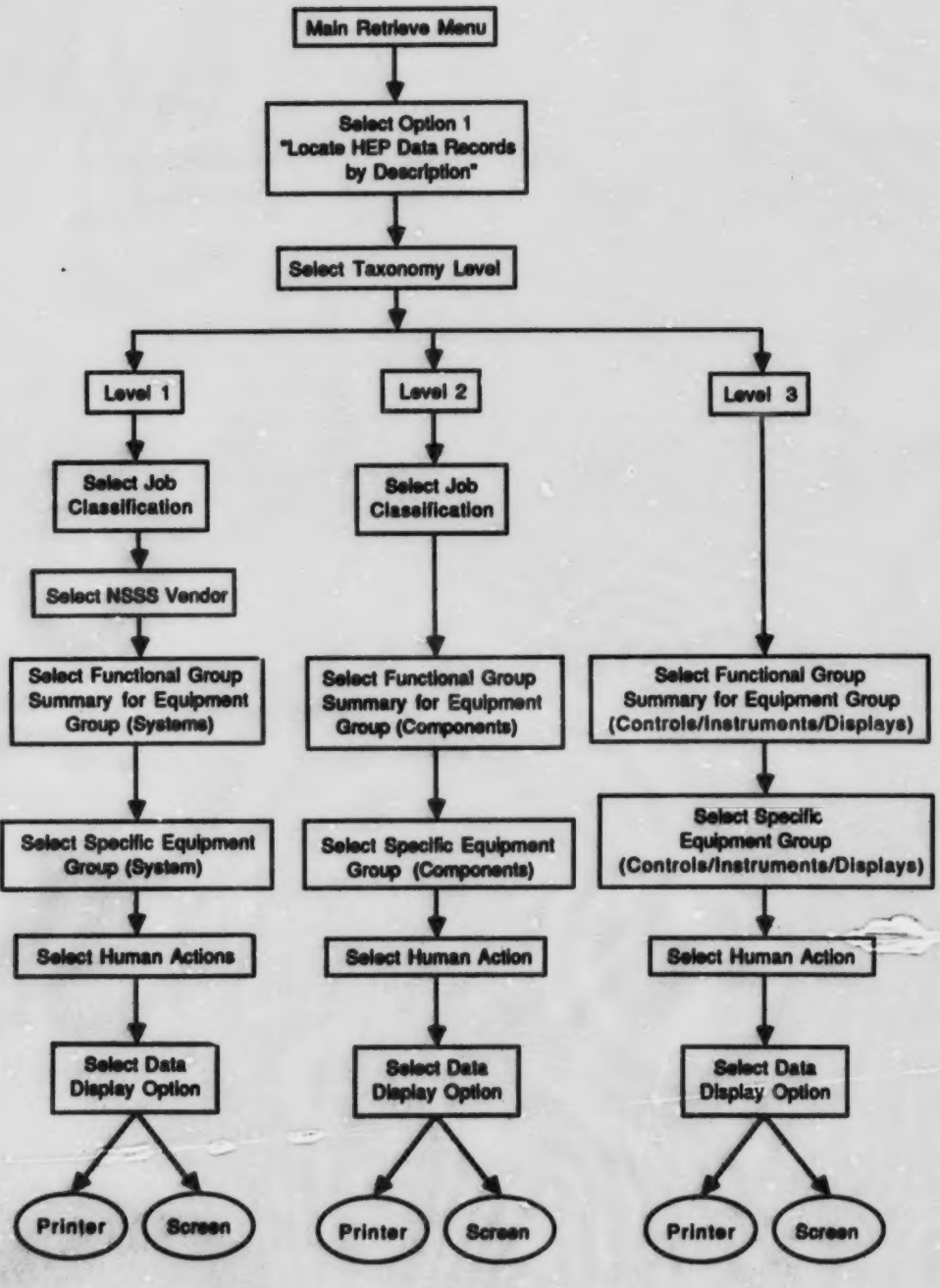

Figure 2. Flow chart for performing a descriptive search--HEP side.

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TABLE 4. GLOSSARY OF DESCRIPTIVE SEARCH MENUS--HEP

Menu/Name Options	Purpose
Select Taxonomy Level 1 - Level 1: Plant Systems (GE, West, CE, B&W) 2 - Level 2: Plant Components 3 - Level 3: Display/ Instrument/ Control	Enables user to select appropriate/ desired level of the taxonomy classification scheme. The three taxonomy levels designate human errors related to a plant system (1), a plant component (2), or a specific control/ instrument/display (3).
Select Job Title 1 - Control Room Operator 2 - Equipment Operator 3 - Maintenance Technician	Enables the user to select the appropriate/desired personnel position related to human error. The three personnel positions available for selection are Control Room Operator, Equipment Operator, and Maintenance Technician. Control Room Operators are persons responsible for control room operations; Equipment Operators are nonlicensed operators responsible for operation of plant equipment not located in the control room; and Maintenance Technicians are mechanical, electrical, or instrumentation and control technicians who maintain, calibrate, and test plant components, including safety-related equipment. (Not applicable to taxonomy Level 3.)
Select NSSS Vendor 1 - General Electric 2 - Westinghouse 3 - Combustion Engineering 4 - Babcock & Wilcox	Enables the user to select the appropriate/desired nuclear power plant classifications as identified by the NSSS vendor that supplied the NSSS portion of the plant. (Applicable to taxonomy Level 1 only.)
Select Equipment Group-- **Functional Group Summary** 000 SUMMARY OF AIR SYSTEMS 010 SUMMARY OF ANNUNCIATOR SYSTEMS 020 SUMMARY OF COMMUNICATION SYSTEMS . . . N SUMMARY OF (FUNCTIONAL EQUIPMENT GROUP)	Enables the user to select the appropriate/desired functionally similar group of plant equipment related to human error. Level 1 taxonomy menus contain categories of plant systems, Level 2 menus contain groups of plant components, and Level 3 menus contain general types of displays/ instruments/controls.

TABLE 4. (CONTINUED)

Menu/Name Options	Purpose
Select Equipment Group-- Equipment Characteristics 090 SUMMARY OF EMERGENCY CORE COOLING SYSTEMS 091 Emergency Core Cooling 092 High Pressure Safety Injection 093 Residual Heat Removal/ Low Pressure Safety Injection . . . 110 SUMMARY OF FEEDWATER SYSTEMS 111 Feedwater 113 Main Feedwater 114 Auxiliary/Emergency Feedwater . . . N (equipment group/ characteristics)	Enables the user to select the appropriate/desired nuclear power plant equipment related to human error. Level 1 taxonomy menus contain plant systems; Level 2 menus contain plant components; and Level 3 menus contain specific types of displays/ instruments/controls.
Select Human Action 00 TESTS 01 OPERATES 02 MONITORS 03 DIAGNOSES . . . N (human action)	Enables the user to select the appropriate/desired human action verb related to human error. The human action verb is the behavioral term associated with the human-machine interface; the duties, tasks, and task elements associated with nuclear power plant personnel.
Data Display Options 1 View Located Record: 2 Report without Aggregated HEPs 3 Report with Aggregated HEPs	Enables the user to display the appropriate/desired HEP data on the NUCLARR computer monitor, copy the data to a NUCLARR computer file, or create a hard copy of the data with the NUCLARR system printer.

6.2 Hardware Component Failure Data

A flow chart depicting the organizational structure of the menu/commands for the descriptive search mode for component failure rate data is shown in Figure 3. The individual steps required for performing a descriptive search are summarized below.

Step 1 -- Select hardware category (mechanical or electrical)

Step 2 -- Select component type

Step 3 -- Select component design[a]

Step 4 -- Select failure mode[a]

Step 5 -- Select normal state[a]

Step 6 -- Select application[a]

Step 7 -- Select search buffer options (view event aggregations, view selected data records)

A glossary of the individual descriptive search menus and their options for hardware components is presented in Table 5.

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a. In Steps 3 through 6, all is a possible option for each selection.

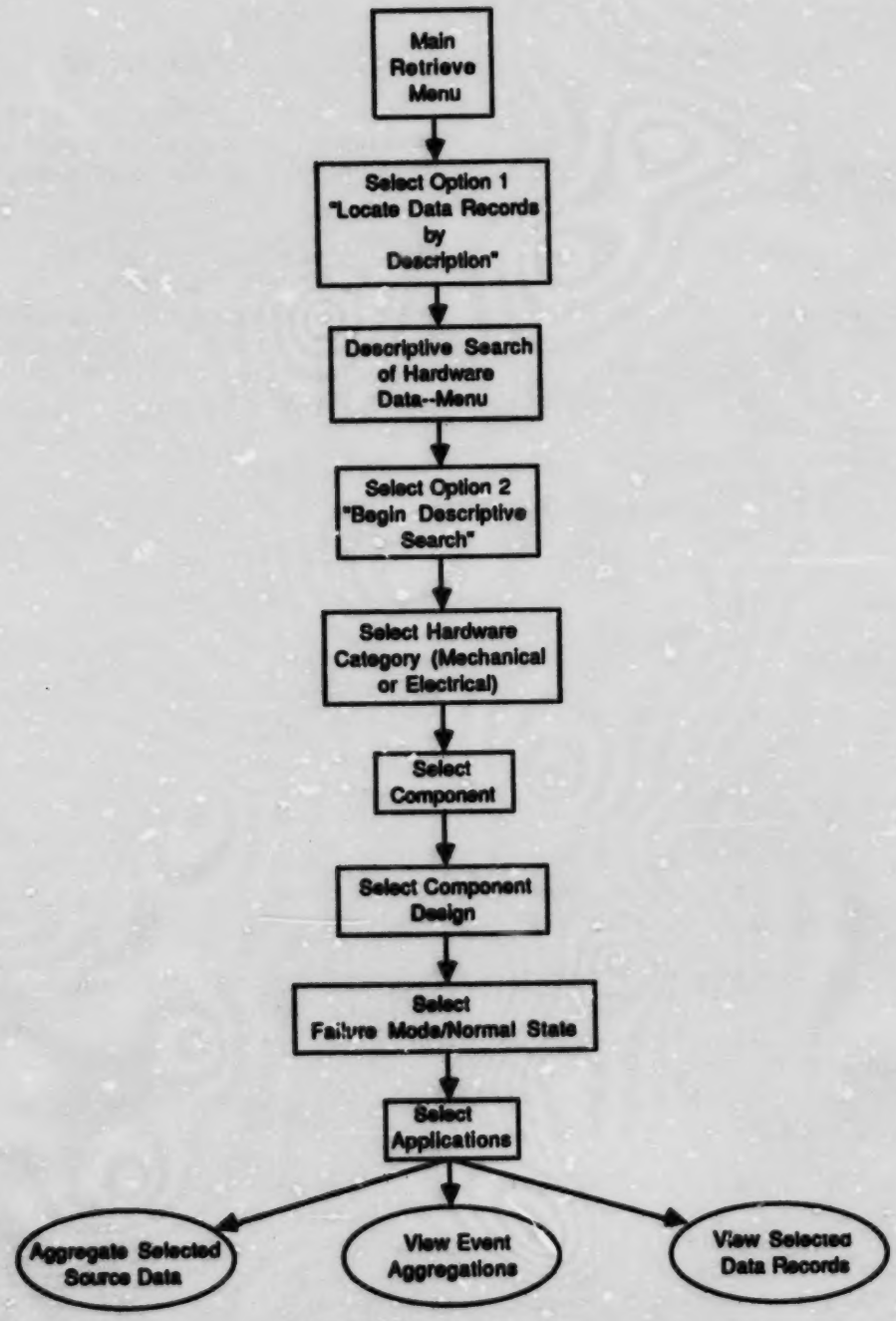
Main Retrieve Menu
Select Option 1 "Locate Data Records by Description"
Descriptive Search of Hardware Data--Menu
Select Option 2 "Begin Descriptive Search"
Select Hardware Category (Mechanical or Electrical)
Select Component
Select Component Design
Select Failure Mode/Normal State
Select Applications
Aggregate Selected Source Data
View Event Aggregations
View Selected Data Records

Figure 3. Flow chart for performing a descriptive search--HCFD side.

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TABLE 5. GLOSSARY OF DESCRIPTIVE SEARCH MENUS--HCFD

HCFD Menu/Name Option	Purpose
Select Hardware Category 1 Mechanical 2 Electrical	Enables the user to display all mechanical or electrical component descriptions on the next search menu.
Select Component ACC 0 Accumulators (closed, pressurized) ACU 3 Air Conditioning Units/ Chillers ADY 0 Air Dryers BLC 0 Blowers/Compressors CON 0 Control Rods . . . N (component)	Enables the user to select one hardware component for the previously selected category. The number appearing before the component is the number of associated source records currently in the data base.
Select Design PPD 5 Pumps, Diesel Driven PPDAX 0 Axial PPDCF 0 Centrifugal PPDDP 0 Diaphragm . . . N (design)	Enables the user to select the appropriate/desired design for the component previously selected.
Select Failure Mode/Normal State F Select Failure Mode N Select Normal State **Failure Modes** ALL 5 All Valid Failure Modes FTG 5 Fails to Operate Group FTO 0 Fails to Operate FTS 4 Fails to Start FTR 1 Fails to Run . . . N (failure mode)	Enables user to select appropriate hardware failure mode or normal operating state.

TABLE 5. (CONTINUED)

HCFD Menu/Name Option	Purpose
Normal States ALL 4 All Valid Normal States NA 0 Normally Alternating NL 0 Normally Locked-out NS 4 Normally Standby . . . N (normal state)	
Select Applications ALL 6 All data points from prior selections INTERNAL ENVIRONMENT APPLICATIONS INTEAR 0 Air Internal Environment INTECG 0 Compressed Gas Internal Environment INTECL 0 Chlorine Internal Environment . . . N (environment)	Enables user to select appropriate/ desired environment or other applications defined for the previously selected hardware.
Search Buffer Options 1 - Aggregate Selected Source Data 2 - View Event Aggregations 3 - View Selected Data Records	Enables user to select search buffer options to aggregate selected data currently in buffer, view the resulting aggregations, and view (and/or unselect) source records currently in the buffer.

7. DATA SEARCH AND RETRIEVAL TECHNIQUES: USING THE AD HOC SEARCH

The NUCLARR system allows the user a powerful ad hoc search capability in both the HEP and HCFD sides. The ad hoc search includes everything in the descriptive search but differs first in that it includes all the remaining data attributes. This allows the analyst to pick and choose those aspects of the data he/she feels are most important or appropriate to use. The second advantage of the ad hoc search is that it is quicker for experienced users who know exactly what search parameters they desire. Furthermore, one can do a search, note the results, clear the buffer, then do another search by just making minor changes to the previously entered search criteria. Thus, it is much faster for specifying a series of searches of the data base.

At any time during the search process, it is possible to escape or to back out through the menus to change some search parameters (for example, reselect the component designs). When a search has been completed, the software allows the user to easily return to the ad hoc screen which was selected from, complete with all the entries used in the last search. This allows the user to adjust the search entries to generate an optimal amount of data for aggregation. On successive searches, without clearing the buffer, a new set of records is formed through the union of the new group and the previous group.

In a case where one field can contain multiple values, such as the system field, all values entered by the user in the search menus must be present in a data record for that record to be retrieved. However, the reverse is not required; the user-entered values can be a subset of the values listed in a data record. Additionally, the order of the listed values is not a factor in the search.

The software provides the capability to allow the user to interactively page through the result of a NUCLARR search and to either select or de-select located data records before performing an aggregation.

Help screens are provided for each field identifying the valid entries for that field. In some cases, there will be a requirement for a lower level, more detailed, help which explains each of the possible entries. These will be addressed in future revisions of the software on an as-needed basis.

Examples of the ad hoc search screens for the HEP and HCFD sides of the system are displayed in Figures 4 and 5, respectively. Selection of parameter options is made by entering one or more alphanumeric codes in the fields provided. In cases where all available options for a particular parameter are explicitly displayed on the ad hoc search screen, an X is used to enter the desired option. After the desired parameter options have been selected by the user, as evidenced by a code or X in the various fields, the functions in the command line can be used to locate the data set. The locate function is used to bring the data set into the buffer. When the locate routine is finished, a tally showing the number of records found by the system is displayed in the upper-right-hand corner of the ad hoc search screen. From this point, with the aid of the appropriate command functions, the user can then select the option to view the data records and/or aggregate the located data. While in the ad hoc search mode, the user can also clear the buffer and revise the search strategy by redefining a new set of parameter options.

A complete glossary which describes the ad hoc search parameters and selectable options for HEP and HCFD sides of the NUCLARR system is shown in Tables 6 and 7.

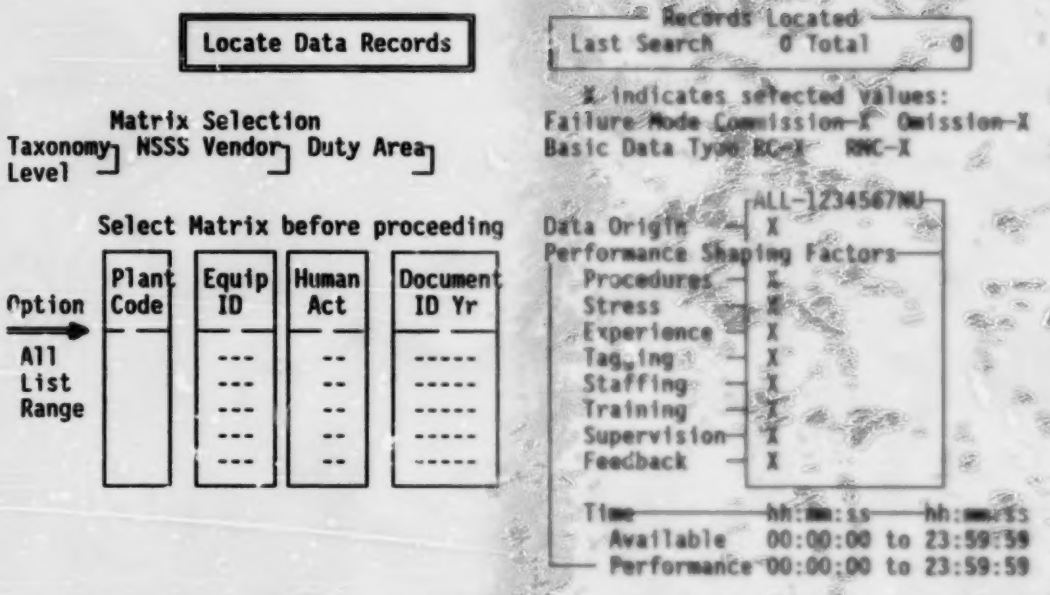

Figure 4. Ad hoc search screen--HEP side.

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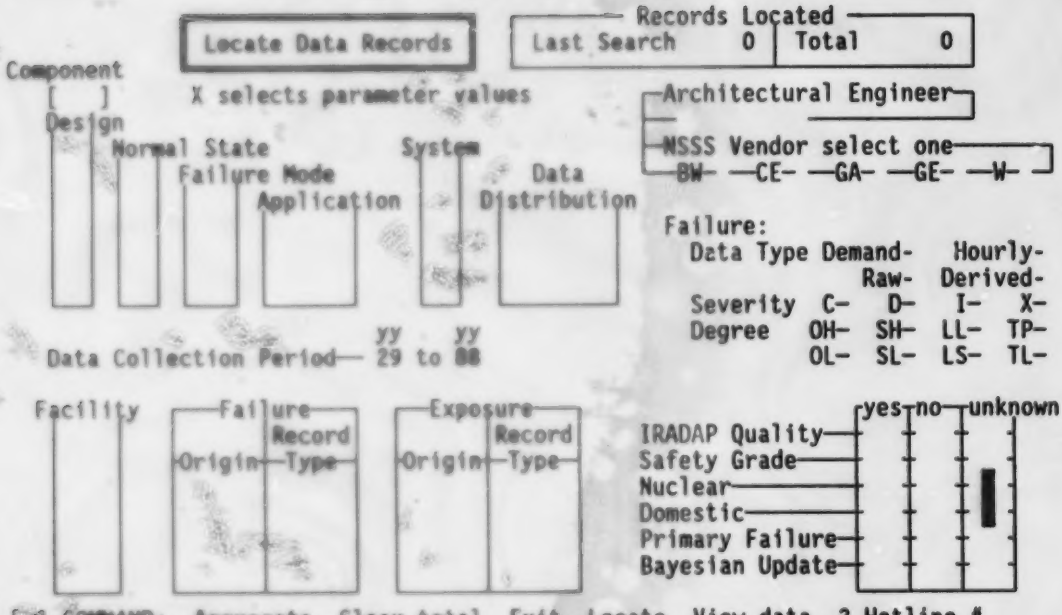

Figure 5. Ad hoc search screen--HCFD side.

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TABLE 6. GLOSSARY OF SEARCHABLE PARAMETERS AND OPTIONS FOR AD HOC SEARCH--HEP

Parameter	Description of Options
Taxonomy level	HELP screens; Vol. IV, Part 3, Sect. 3.1
NSSS vendor	HELP screens; Vol. IV, Part 3, Sect. 3.1.1
Duty area	HELP screens; Vol. IV, Part 3, Sect. 3.1.1
Plant code	HELP screens; Vol. IV, Part 3 Sect. 3.2.3.2 and Appendix H
Equipment ID	Vol. IV, Part 3, Appendix A
Human action	Vol. IV, Part 3, Appendix A
Document ID-Yr	Vol. IV, Part 3, Section 3.2.3.2, Document File
Failure mode	HELP screens; Vol. IV, Part 3, Sect. 3.2.2
Basic data type	HELP screens; Vol. IV, Part 3, Sect. 3.2.2
Data origin	HELP screens; Vol. IV, Part 3, Sect. 3.2.3.2
PSFs	HELP screens; Vol. IV, Part 3, Sect. 3.2.3.3
Time--available	HELP screens; Vol. IV, Part 3, Sect. 3.2.3.4
Time--performance	HELP screens; Vol. IV, Part 3, Sect. 3.2.3.4

TABLE 7. GLOSSARY OF SEARCHABLE PARAMETERS AND OPTIONS FOR AD HOC SEARCH MODE--HCFD

Parameter	Description of Options
Component	HELP screens; Vol. IV, Part 3, Appendix F
Design	HELP screens; Vol. IV, Part 3, Appendix F
Normal state	HELP screens; Vol. IV, Part 3, Table 6
Failure mode	HELP screens; Vol. IV, Part 3, Table 5
Application	HELP screens; Vol. IV, Part 3, Appendix G
System	HELP screens; Vol. IV, Part 3, Appendix I
Data distribution	HELP screens; Vol. IV, Part 3, Table 7
Data collection period	HELP screens; Vol. IV, Part 3, Sect. 4.2.2
Facility (plant code)	HELP screens; Vol. IV, Part 3, Appendix H
Failure data/record type or data origin	HELP screens; Vol. IV, Part 3, Table 9
Exposure data/record type or data origin	HELP screens; Vol. IV, Part 3, Table 9
Architectural engineer	HELP screens; Vol. IV, Part 3, Section 4.2.3
NSSS vendor	HELP screens; Vol. IV, Part 3, Sect. 4.2.3, Appendix H
Data type	HELP screens; Vol. IV, Part 3, Sect. 4.2
Failure - severity	HELP screens; Vol. IV, Part 3, Sect. 4.2.3
Failure - degree	HELP screens; Vol. IV, Part 3, Table 8
IRADAP quality	HELP screens; Vol. IV, Part 3, Sect. 4.2.3
Safety grade	HELP screens; Vol. IV, Part 3, Sect. 4.2.3
Nuclear	HELP screens; Vol. IV, Part 3, Sect. 4.2.3
Domestic	HELP screens; Vol. IV, Part 3, Sect. 4.2.3
Primary failure	HELP screens; Vol. IV, Part 3, Sect. 4.2.3
Bayesian update	HELP screens; Vol. IV, Part 3, Sect. 4.2.3

8. FILE/BUFFER MANAGEMENT

8.1 Placing Located Records into the Buffer

Key values of all data records located by the user from the NUCLARR system are automatically stored in the buffer of the computer. (The buffer is a temporary holding area in NUCLARR's memory for up to 200 key values identifying data records selected by the user.) The records will remain in storage until the user chooses to either (a) exit from the main menu or (b) clear the buffer with a command option. While the records are being held in the buffer, the user can elect to modify the buffer by initiating new searches and/or removing individual records. For example, suppose that an ad hoc search on selected parameters found only two data records. The user may, at this point, choose to expand the search criteria and search on a larger group of records. Provided that no option is taken to clear the buffer before initiating a new search, the next set of located records will simply be added to the original set of two records already residing in the buffer. Of course, in no instance are duplicate records saved in the buffer. The rules for storing and removing files from the buffer area are the same between the descriptive (menu-driven) and ad hoc search modes. The only difference resides in the mode taken to locate a set of records from the data base. After a set of records has been located by the user, placed in the buffer, and any appropriate modifications have been made to the user's satisfaction, one or more of the following steps can be taken:

- Place the located records out to a file on the disk.
- Generate a hardcopy report of the located records in the buffer.
- View the contents of the buffer on the console (screen).
- Perform additional manipulations to the data, such as data aggregations for the set of located records.
- Generate graphical plots of the located data records.

It is recommended that files of records be made if, at any time, the user would like to maintain a buffer for future reference. In order to retrieve a stored file, i.e., bring a file back into the buffer, the options can be easily selected from the main menu. There is no limit to the number of times the user can elect to call up records from a file to be placed into the buffer, make the desired modifications, and put the revised buffer back onto one or more files with the options from the main menu. It should be noted, however, that in order to change or alter a file, it must be brought back into the buffer for those changes to be performed.

8.2 File Management

There are two primary functions that can be performed by the NUCLARR system in the the area of file management. The first function, as discussed previously, gives the user the option to save records residing in the buffer to a file and recall them at a later date. The second function provides the flexibility to prepare a file for export to other software packages. The NUCLARR system currently has the format capability to set up any file of located records for acceptance by dBase III+, SAS, and/or SPSS. Examples of the set up screens for formatting the NUCLARR record file are shown in Figure 6. The options for file set-up can be selected from the main menu. ASCII conversion of the files is performed automatically from the set-up screen. As a result, with the ASCII conversion, almost any record of NUCLARR system files can be readily moved to an ASCII file for transport to other systems or applications. A flow chart depicting the organizational structure of the menu/commands for general file management functions is shown in Figure 7.

```
Conversio

                                Enter File Name: [DATA                ]
[A] All data / Located data
------------------------------
[Y] Source Statements  (Y/N)
  [Y] Identification (cell, task, source statement)  (Y/N)
  [Y] Failure mode     (Y/N)
  [Y] Data type        (Y/N)
  [Y] HEP data         (Y/N)
  [Y] PSF's (scaled)   (Y/N)
  [Y] Time available/time perform  (Y/N)
  [Y] Plant code       (Y/N)
  [Y] Data origin      (Y/N)
  [Y] Document         (Y/N)

[N] Task Statements    (Y/N)

[N] Document File      (Y/N)

[N] Complete set of data base descriptions  (Y/N)

COMMAND: [F]  Conversion  Exit  Filename  ? clearinghouse
```

Figure 6. Examples of set-up screens for conversion of NUCLARR system records to other software programs--HEP side.

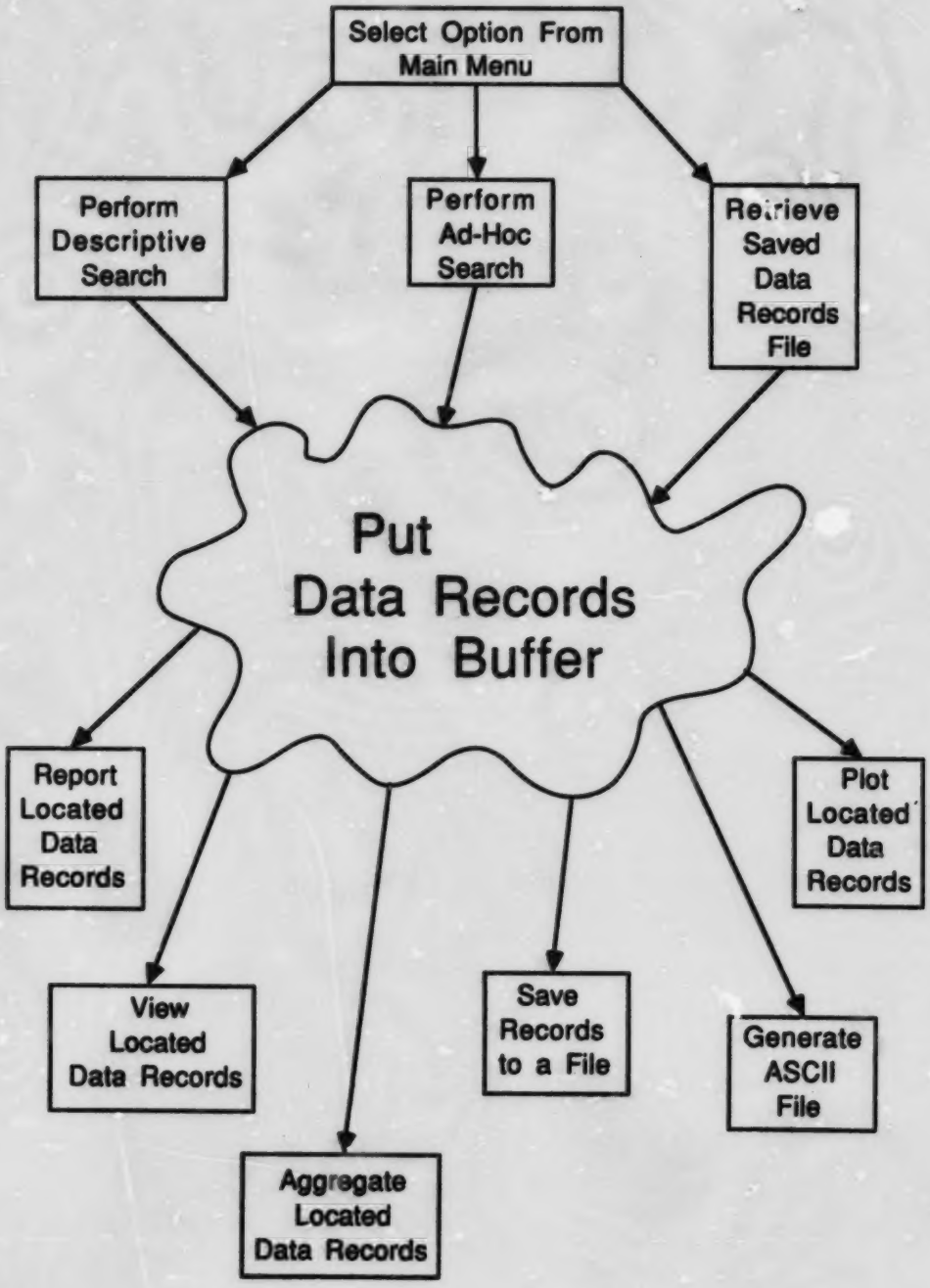
Select Option From Main Menu
Perform Descriptive Search
Perform Ad-Hoc Search
Retrieve Saved Data Records File
Put Data Records Into Buffer
Report Located Data Records
Plot Located Data Records
View Located Data Records
Save Records to a File
Generate ASCII File
Aggregate Located Data Records

Figure 7. Flow chart for file management functions--HEP side.

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9. DATA AGGREGATIONS

The NUCLARR system makes use of various algorithms for taking a selected set of source data points (input data) and combining them to produce a single aggregated data value. Aggregations of task statement HEPs are also performed. The output obtained from an aggregation consists of a single data point estimate and distribution limits. In the case of aggregated HEP values, the limits are displayed as upper and lower confidence bounds. For hardware component failure rates, the limits are upper tolerance bounds. The aggregated value can be beneficial during the course of a risk analysis when (a) no original source data points are available that fit a particular application, (b) only a top level or screening value is needed for the particular analysis, and/or (c) many source data points apply to the situation being modeled.

Data aggregations are executed both automatically and manually (i.e., user-initiated) by the NUCLARR system. The type and degree of aggregation varies according to the side of the data base (HEP or HCFD) in use and the type of search selected (descriptive or ad hoc). The unique attributes of the aggregation capabilities for each side of the system, HEP and HCFD, are described below.

9.1 Human Error Probability

The following types of automated data aggregations currently reside in the NUCLARR system:

- Functional group summary HEP (human actions associated with general equipment groups)
- Cell HEP human actions associated with more specific equipment (may still describe a variety of situations)
- Task statement HEP (similar situations for a human action and associated equipment)

In each of these cases, as many as four aggregated or average HEPs are computed (depending on the data present). Specifically, HEPs are computed separately for omissions and commissions, and HEPs that reflect the consideration of recovery actions are never combined with HEPs for which recovery was not considered.

These aggregations are automatically calculated during the data entry process and stored for later retrieval. In summary, original data points that share a common task statement are rolled up to formulate an aggregation for the task. All task HEPs for that equipment and human action combination are then aggregated together to form an HEP for the entire cell.[a] Finally, all task HEPs with equipment characteristics assigned to the same functional group and with the same human action are aggregated to form functional group summary HEPs. All of these precomputed aggregations are performed in accordance with the requirements dictated by the cell matrix structures of the HEP data taxonomy. In all cases, data on commission errors are not combined with data on omission errors (failure mode) and data with recovery considered are not combined with recovery not considered errors (data type). The automated HEP aggregations for task, cell, and functional group summary can be accessed from the descriptive search mode and, as stated previously, remain fixed until new sources of data are added to the NUCLARR system by the Human and Hardware Reliability Analysis Group (HHRAG) group at the INEL. An example of the output of fixed aggregated data values that can be viewed from a descriptive search is shown in Figure 8.

The prior or <u>fixed</u> data aggregations are supplemented with a user option to perform manual aggregations on selected sets of data records. For example, there are often cases where it may be advantageous to derive the aggregated value from a record set located by an ad hoc search. Since

---

a. Cell--defined by the relationship between a human action and an equipment characteristic within the matrices of the HEP taxonomy, where human actions are defined as columns and equipment characteristics are defined as rows.

```
Taxonomy Level: 3
Matrix: 16                                          Page Number: 1601066

Job Title: Personnel
Human Action Verb: READS
Equipment Class: SUMMARY OF QUANTITATIVE DISPLAYS
NSSS Vendor/Equipment Level: Displays/Instr/Controls

ERRORS OF OMISSION
RECOVERY CONSIDERED      HEP:  .0011668    UCB:  .0027692    LCB:  .0004916

ERRORS OF COMMISSION
RECOVERY CONSIDERED      HEP:  .0024939    UCB:  .0055065    LCB:  .0011295

ERRORS OF COMMISSION
RECOVERY NOT CONSIDERED  HEP:  .0146641    UCB:  .0363608    LCB:  .0059139

Strike space-bar to continue, <Enter> for return to selection menu
```

a. Functional group summary HEP.

```
Taxonomy Level: 3
Matrix: 16          Buffer Viewing from Descriptive Search     Page Number: 1601366

Job Title: Personnel
Human Action Verb: READS
Equipment Class: Meter
NSSS Vendor/Equipment Level: Displays/Instr/Controls
                  Aggregated HEPs
 1.                 Task ----> Cell
                  Mean  :  .0028938    .0073564
                  Median:  .0010000    .0058857
                  UCB   :  .0100000    .0165115
                  LCB   :  .0000900    .0020980   h clearly drawn mimic lines
                  EF    :         11           3
    COMMISSION DATA  RECOVERY CONSIDERED
*   1) Document:   2-84  pg. c-7, item 7      Reference : ------  Page:
    + Mean: .0028938     Median HEP  : .0010000 Stress     :U     Feedback:U
    + E   :      .1   + Error Factor: 11       Experience :3     Staffing:1
    + N   :    100.0     Plant Code  :BWR      Supervision:U     Tagging :U
      UCB : .0100000     Perform Time:--:--:-- Procedure  :U     Training:U
      LCB : .0000900     Time Avail. :--:--:-- Origin:Psychological Scaling

* = Used in HEP Calculations, + = NUCLARR calculated    <Tab> & <Esc> field Help
[ ] COMMAND:  Exit Next Previous  Clear aggregated HEPs  Unselect  ? hotline #
```

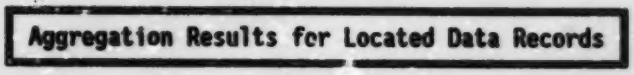
b. Task and cell HEPs (shown in window overlay).

Figure 8. Sample outputs of fixed data aggregate values for functional group, cell, and task HEPs.

the data obtained by an ad hoc search is user-driven, no a priori aggregations for the customized data subset exist. A single aggregation on a located set of records provides the user with a valuable summary overview regarding the nature and type of data that was searched upon. User-initiated aggregations are also useful whenever a set of records located from a descriptive search has been modified--as observed when one or more data record has been unselected from the buffer. It is important to note that whenever the original buffer has been modified, any original fixed data aggregations may no longer be valid for the revised data set. In additionl, only a maximum of 200 data points can be aggregated at any one time. An example of the output obtained from a user-initiated aggregation is shown in Figure 9.

Aggregations are generally calculated on line without additional requests for input from the user. Once the command option for aggregation is entered, the user only needs to stand by until the calculation is completed. However, these aggregations are based on a statistically homogeneous subset of the records in the buffer; and, if such a subset cannot be located, the user must make a decision to select which HEP data point and bounds, if any, to output as the aggregated value that represents the data set. An example of the screen that automatically appears to make these selections when needed is shown in Figure 10. Factors that should be considered in selecting the most appropriate data point are: (a) the value of N (number of opportunities--a large N is preferable); (b) the HEP data point itself (a higher value is more conservative); and (c) PSFs (those PSFs representing normal conditions are preferable). If there is doubt regarding a choice, contact the NUCLARR Data Clearinghouse for assistance.

A flow chart depicting the organizational structure of the menu/commands for performing a user-initiated aggregation for HEP is shown in Figure 11. An overview of the menu/commands for viewing the fixed data aggregations (functional group summary, cell, task) is shown in Figure 12.



Functional (Median based on Geometric Average)

HEP : .0101682

UCB : .0134083

LCB : .0077110

user-supplied description of located records

Taxonomy Level 3, all equipment, omission, recovery considered

COMMAND [ ]: Exit Report ? hotline #

Figure 9. Sample output of user-initiated data aggregated values--HEP sign.

Page Number
1600569

HEP Task Statement Calculations -- Case Three

EITHER select an HEP data point to continue aggregation
OR abort aggregation. See help screen for details.

Task
1

Source	E	N	Median HEP	UCB	LCB
1)	20.0	20.0	1.0000000	1.0000000	1.0000000
2)	6.0	12.0	.5000000	1.0000000	.2500000
3)	.1	1.0	.1000000	1.0000000	.0100000
4)	.1	10.0	.0100000	.1000000	.0010000
5)	.1	100.0	.0010000	.0100000	.0001000
6)	.1	1000.0	.0001000	.0030000	.0000033
0)	.0	.0	.0000000	.0000000	.0000000

[---] = Number of HEP data point to be used in the aggregation calculations
COMMAND [ ] : Abort aggregation Entry of choice Next 7 Previous 7

Figure 10. Display screen for making expert judgments to determine the most appropriate HEP value for data aggregation.

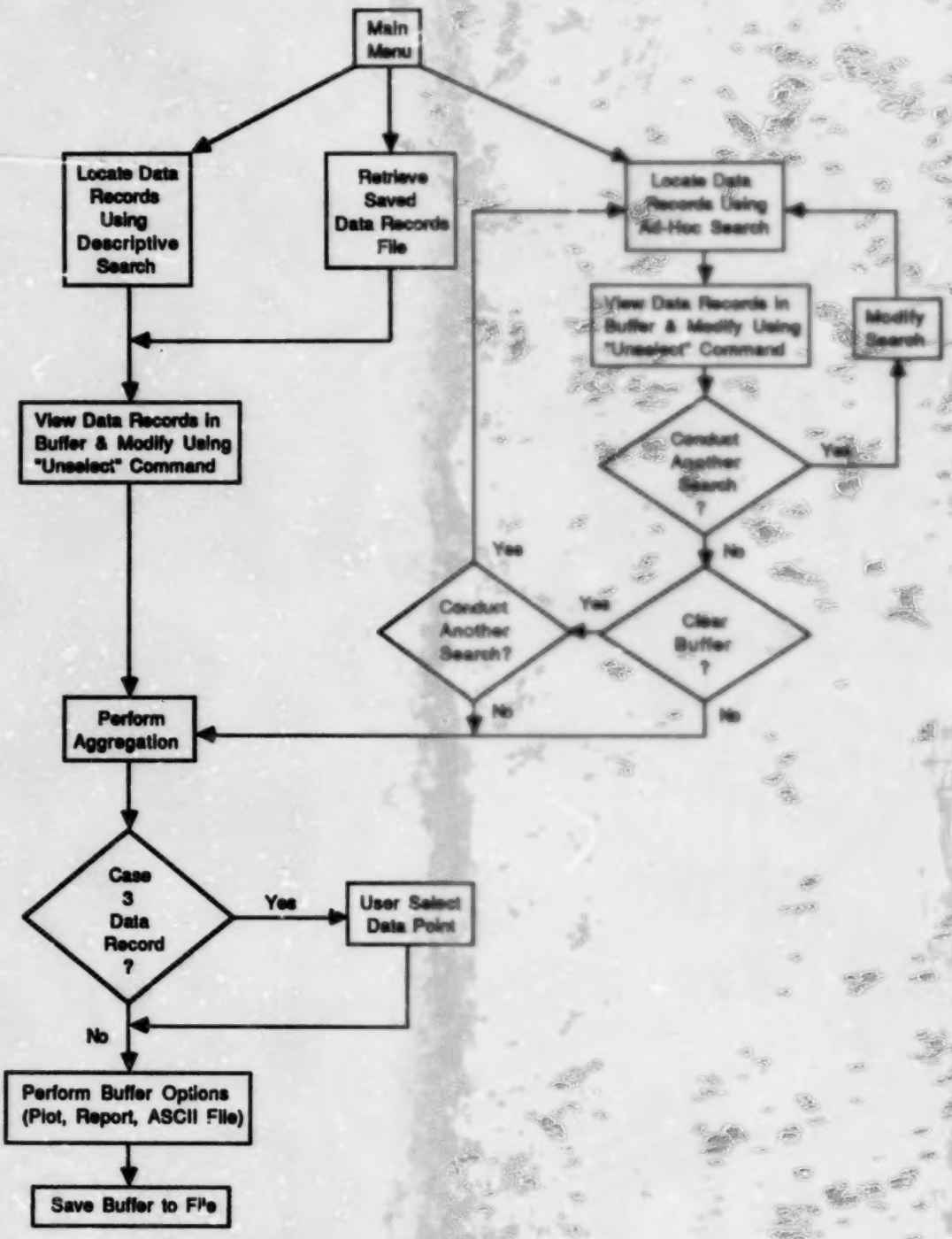


Figure 11. Flow chart for performing user-initiated data aggregations--HEP side.

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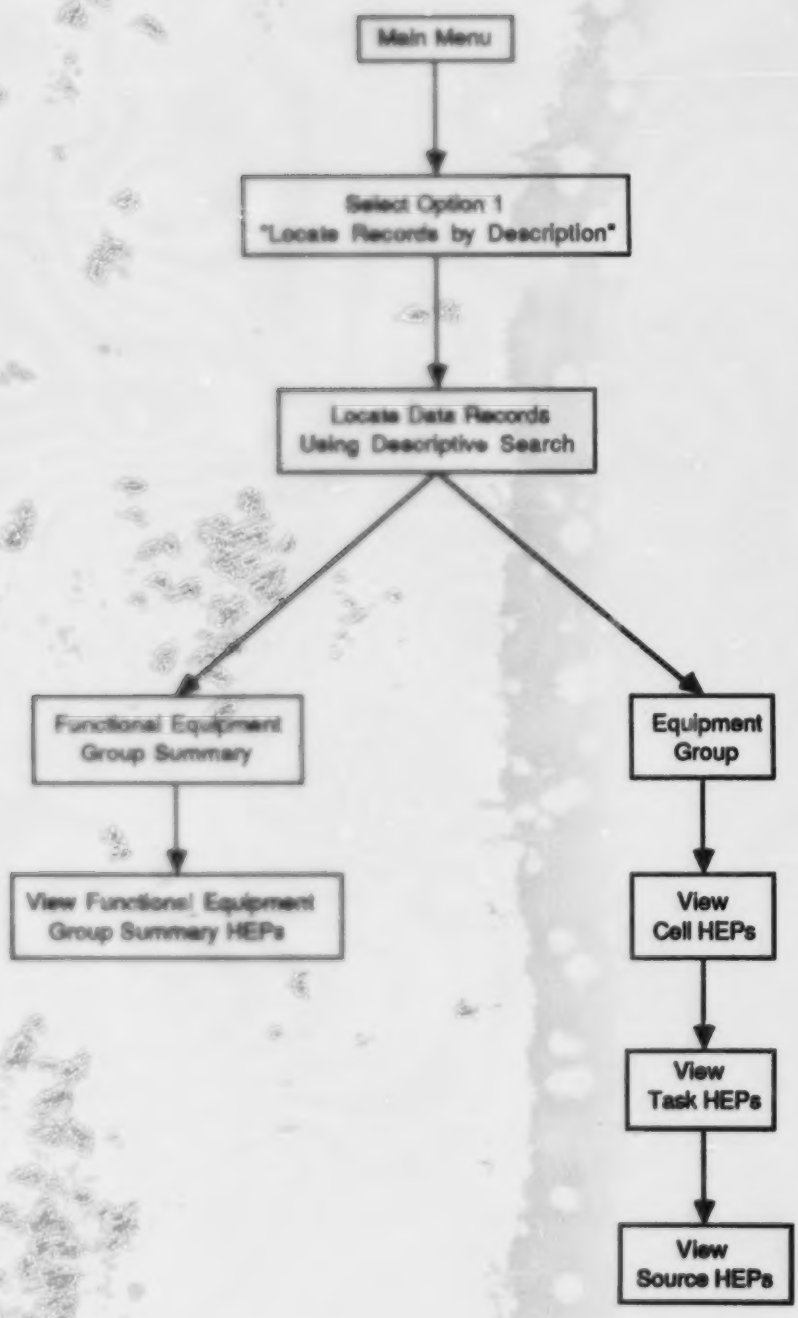

Figure 12. Flow chart for viewing fixed data aggregations--HEP side.

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9.2 Hardware Component Failure Data

Data aggregations for component failure rate data are automatically calculated for all data records that have the same event, where basic events are defined, as a minimum, by the following search parameters:

- Component type (including whether mechanical or electrical), and
- Failure mode group (e.g., fail to operate, spurious operation).

All data values possessing the same attributes for the above parameters are selected and combined from the data base or search buffer for data aggregation.

Note that this may result in more than one event aggregation being formed. If, for example, all the records in a set being aggregated are for motor-operated valves but some describe leakage and some describe failure to open (a failure mode in the fails-to-operate group), at least two event aggregations will be formed. The possibility for three such events exists because failure rates are never combined with per-demand probabilities. Both forms of data (per hour and per demand) are possible for the fails-to-open mode. When the results of the aggregation are viewed, next event and previous event commands allow the user to see all the possibilities.

For viewing the automatic aggregations, the event parameters are defined in the course of a descriptive search. When a descriptive search is completed and the user receives the prompt to view the located data records, the first screen contains the aggregated data value for the first event. Each lower level screen (summary source and raw data) displays an original input value to the aggregation.

The automated aggregation value is valid only for the located set of records obtained from the descriptive search. Any options to update or modify records from the buffer will nullify the data aggregation, making it

no longer representative of the original population of records. After a descriptive search has been completed, the user has the option to modify the buffer by (a) removing records from the buffer, using the unselect option in the command line and/or (b) selecting the option to tailor the buffer with the aid of the screen shown in Figure 13. If any changes to the buffer are made, however, a manual or user-initiated data aggregation should be performed on the resultant revised set of data records. The user retains the ability to conduct manual aggregations in both the descriptive and ad hoc search mode. Note that only a maximum of 200 data points can be aggregated at any one time. An example of the output showing the data aggregation obtained from a manual, or user-initiated, search is shown in Figure 14.

Aggregations for events defined from other variables present in the record header will be displayed in future versions of NUCLARR. In addition to the component/failure mode group aggregations just discussed, aggregations for events defined by the following four sets of variables are currently calculated and stored in NUCLARR:

- Component and failure mode
- Component and design and failure mode group
- Component and design and failure mode
- Component, design, failure mode, and normal state

A flow chart depicting the organizational structure of the menu/commands for performing a user-initiated aggregation for component failure rate data is shown in Figure 15. An overview of the menu/commands for viewing the fixed data aggregations is shown in Figure 16.

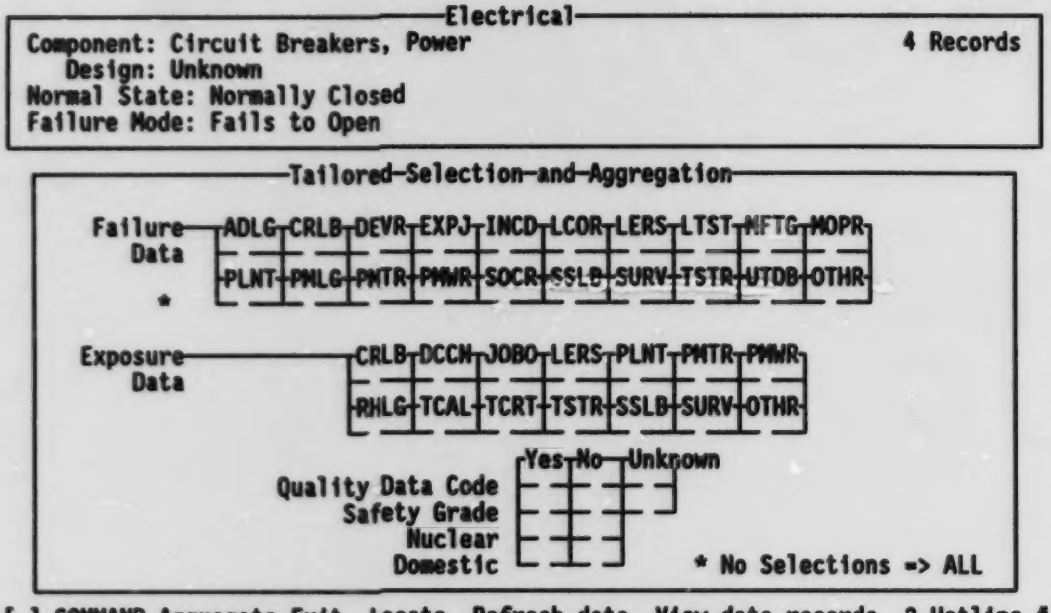
Electrical
Component: Circuit Breakers, Power
4 Records
Design: Unknown
Normal State: Normally Closed
Failure Mode: Fails to Open
Tailored Selection and Aggregation
Failure Data
ADLG CRLB DEVR EXPJ INCD LCOR LERS LTST MFTG MOPR
PLNT PMLG PMTR PMWR SOCR SSLB SURV TSTR UTDB OTHR
*
Exposure Data
CRLB DCCN JOBO LERS PLNT PMTR PMWR
RHLG TCAL TCRT TSTR SSLB SURV OTHR
Yes No Unknown
Quality Data Code
Safety Grade
Nuclear
Domestic
* No Selections => ALL
[ ] COMMAND Aggregate Exit Locate Refresh data View data records ? Hotline #

Figure 13. Display screen for tailoring buffer of data records--HCFD side.

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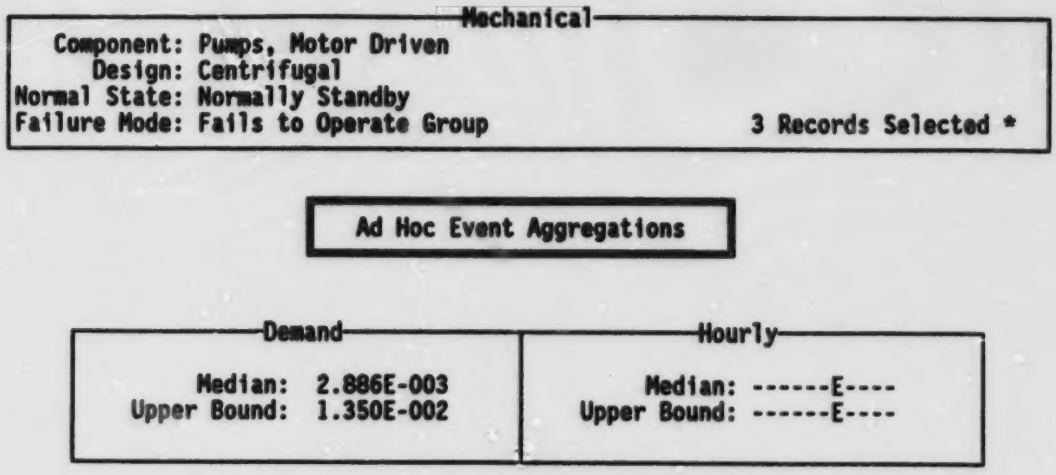

Figure 14. Sample output of user-initiated data aggregated values--HCFD side.

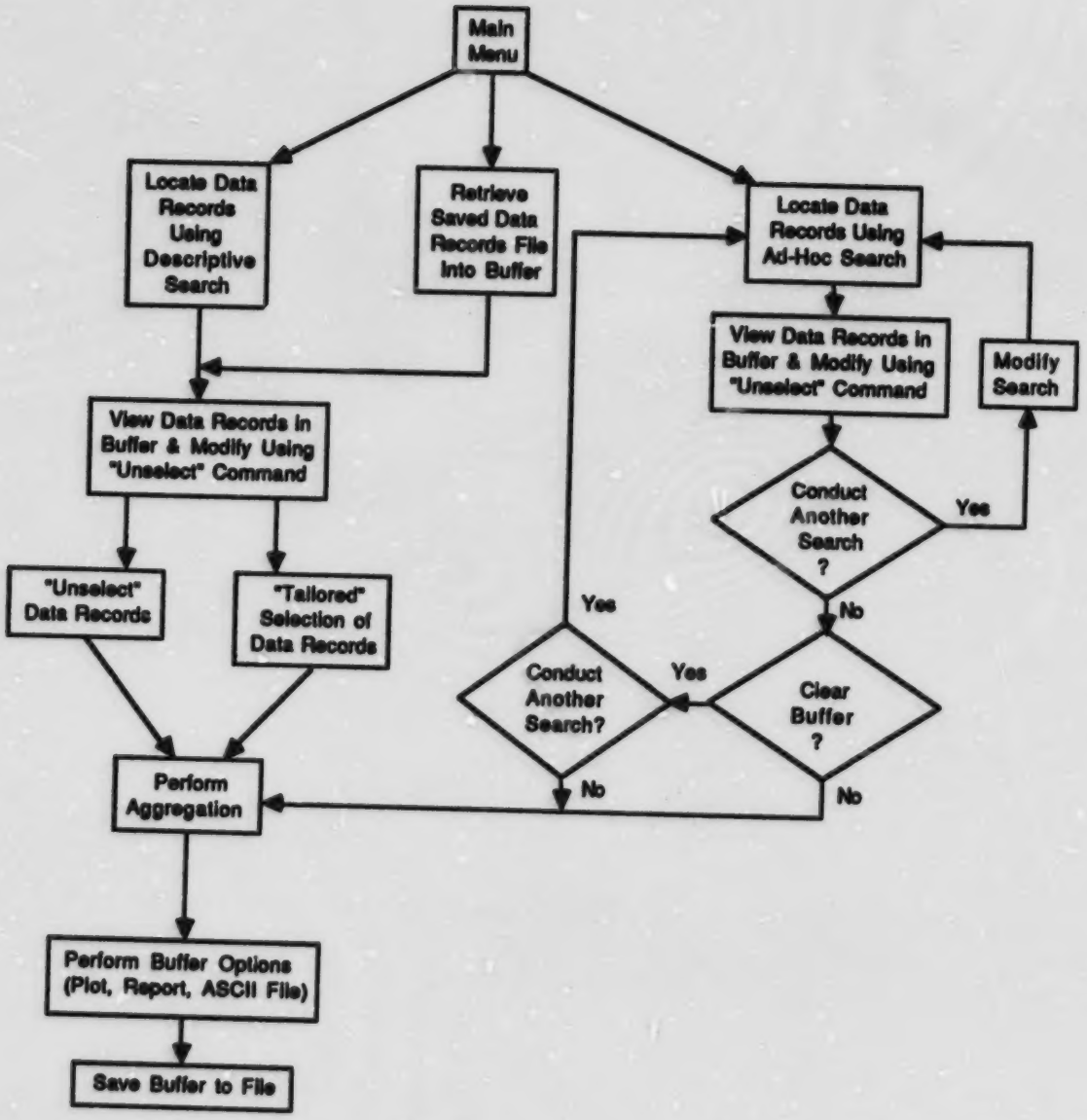

Figure 15. Flow chart for performing user-initiated data aggregations--HCFD side.

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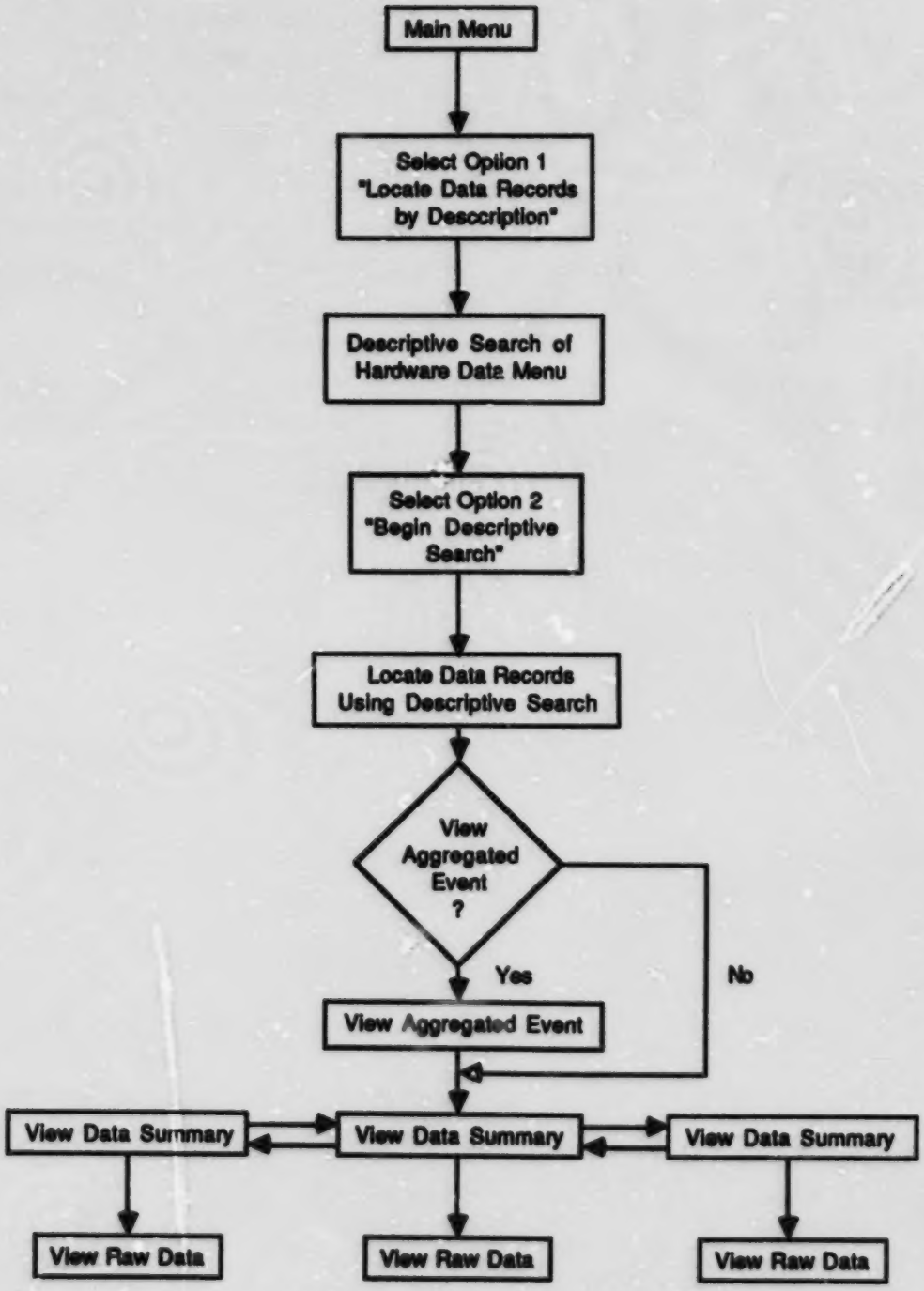

Figure 16. Flow chart for viewing fixed data aggregations--HCFD side.

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10. DATA OUTPUT AND REPORT GENERATION

Any set of data records residing in the buffer can easily be exported to the NUCLARR report generation routines and submitted to a printer for hard-copy output. Options are also available to view the report contents directly from the console (CRT screen). When a report request is made, a prompt is automatically displayed, allowing the user the option to enter a unique title to the final report. If user-initiated aggregations are performed, this information will be included at the front section of the report, preceding the set of located data records. A flow chart depicting the organizational structure of the menu/commands for generating a report of hardware component failure rate data and HEP data is shown in Figure 17.

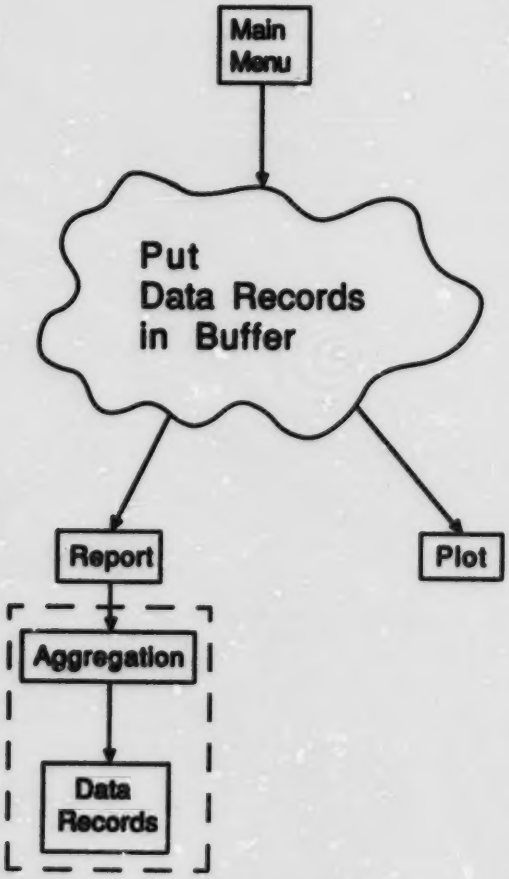

Figure 17. Flow chart for data output and report generation.

11. GRAPHIC PLOT ROUTINES

A located set of data records retained in the buffer can be output to a plot routine. The plot option, selected from the main menu, will take the located data points, including their respective confidence bounds/tolerance limits, and graphically format them on an X-Y Axis. The resulting output will display the individual data points, with vertical lines used to depict the distribution of the data (i.e., upper and lower confidence bounds/limits). The individual points are arranged in ascending order from lowest probability to highest. For any data buffer, only a maximum of 50 data points can be plotted. In addition to the data points obtained from the original records, the aggregated data values for the data set are also displayed. It should be noted that no data plots can be performed unless a data aggregation of the located data records has been completed. If no aggregation has been previously performed, an error message will be displayed, prompting the user to do a data aggregation.

Hard-copy plots of the data can be produced directly from the console (or CRT Screen) by pressing the Print Screen key or, if using an Epson printer, pressing the V key for a vertical plot or the H key for a horizontal plot. An example of a data plot using the graphic plot routine option is shown in Figure 18. If more than 50 points are found, the first 50 points are used, BEFORE SORTING!

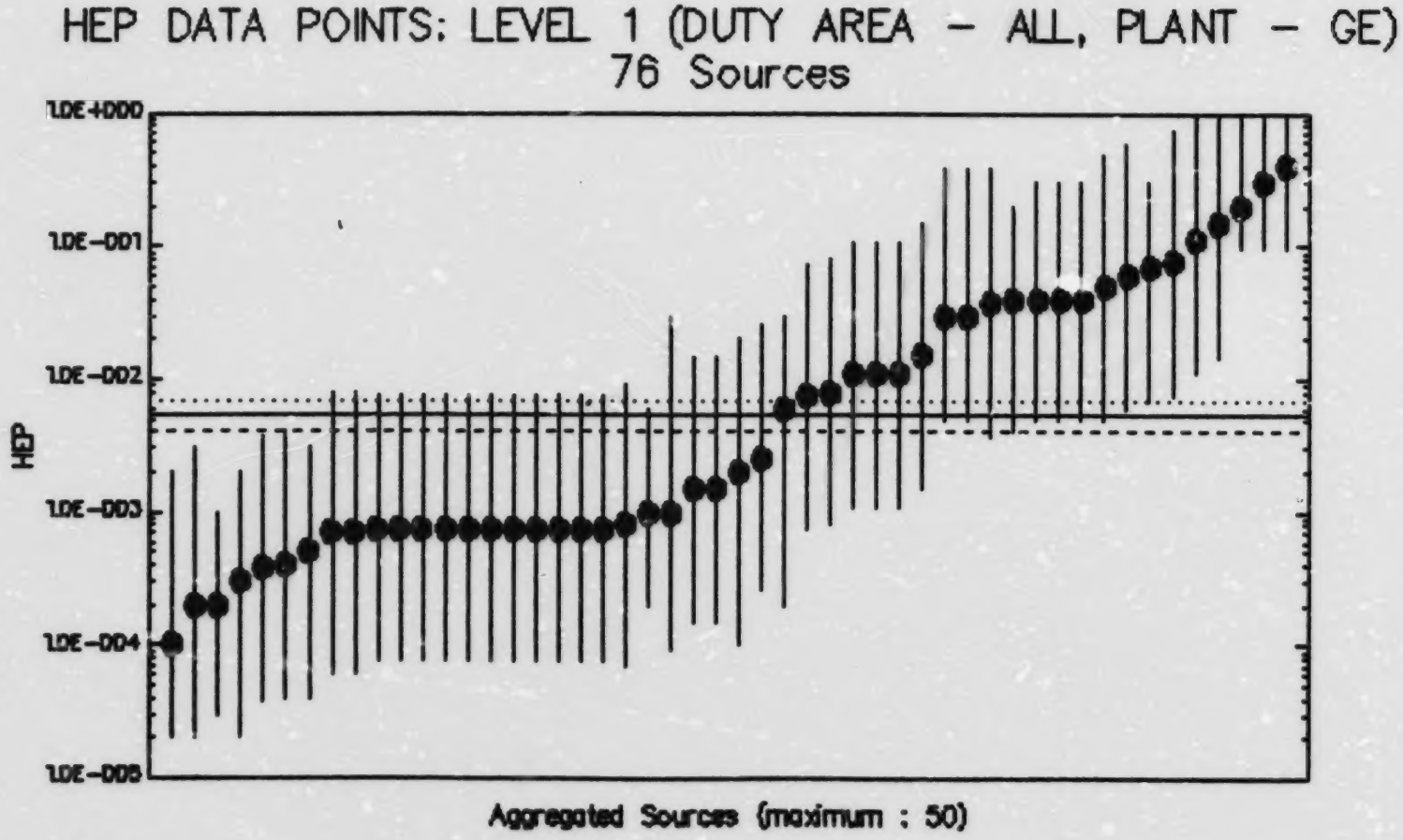

Figure 18. Sample of data plot.

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12. STRATEGIES FOR REVIEWING DATA RECORDS TO DETERMINE THEIR APPLICABILITY

The NUCLARR system was designed to furnish the analyst with sufficient flexibility for addressing a variety of problems that may arise in the course of risk analysis. Though this flexibility was maintained as a goal during its development, maximum utility of the systems features and resident data records can be realized by following a suggested set of predefined strategies. A familiarity with these strategies, and modification of them as needed to meet the needs of a specific application, should result in making the user more effective at accessing and applying the data sources to a particular problem. A step-by-step description of these strategies for the HEP and HCFD sides of the NUCLARR system are discussed separately below.

12.1 Human Error Probability

Step 1: Select a cell (i.e., a human action verb and associated equipment of interest). If there are no data in the cell, proceed to Step 5.

Step 2: Analyze each of the task statements in the cell to determine whether it is the same as the task for which HEP data are required. The structure and content of the task statements are discussed in Vol. IV, Part 3, Section 3.2.2.1 and Appendix B. The following substeps should be used for a systematic comparison of a task statement to the problem task:

(a) For taxonomy Level 1 (systems) and Level 2 (components), compare the system or component state described in the task statement to the state that is applicable to the problem task for which HEP data are required. If the states are different, a judgment should be made as to whether the differences in task requirements between two states are significant enough to affect the error probability.

If the difference in system or component state is significant, the task statement is not the same as the problem task and the next task statement should be analyzed.

(b) If the state is the same or there is no significant difference, compare the standard (e.g., nature of the error) and conditions described in the task statement with those under which the problem task is performed. If they are different, a judgment must be made as to whether the difference has a significant effect on the error probability. If there is a significant difference, the tasks are not the same and the next task statement should be analyzed.

(c) If the state, standard, and conditions of the task statement are not significantly different from the human reliability analysis (HRA) task, review the failures modes reported under the task statement to determine whether the failure mode of interest is included. If the failure mode is included, determine whether the data type needed, recovery considered or recovery not considered, is provided. If the failure mode and data type are not included, the tasks are not the same and the next task statement should be analyzed.

Step 3: If a task statement, associated failure mode, and data type presented in the cell are judged to be the same as the problem task for which HEP data are required, the PSFs must be analyzed to determine the appropriate HEP value. The PSFs are rated for each data point listed for the selected task under the stated failure mode and data type. The HEP of the data source with PSFs that are most similar to those of the problem task should be used. To assist in evaluating PSFs, copies of the source document or the worksheets used in processing the data may be requested from the Data Clearinghouse. If the PSFs applicable to the problem task are not defined, or they match those of the task

statement being considered, the task statement HEP for the identified task statement may be used.

Step 4: If none of the task statements presented on the cell page is judged to be the same as the problem task, the cell HEP data may be considered. The cell HEP data for each failure mode and data type are the log-mean and confidence bounds of task statement HEPs on the cell page. These data represent the average error probability across the range of conditions included in the available data in the cell.

Step 5. If there are no data in the cell, or the analysis of the task statements indicates that none is similar to the problem task, or the cell HEP data are not suitable, alternative sources of data in the NUCLARR system may be located. Using the descriptive search mode, identify the functional group summary cell for the equipment. This summary cell contains a list of available data for all types of equipment within that functional group. The summary cell also includes summary HEP data representing the log average of the HEPs for all tasks involving the same human action verb on equipment in the functional groups. This summary HEP data may be used if more specific data are not available.

Step 6: If suitable data cannot be located by reference to the functional group summary, determine whether the same functional group is in other matrices. If it is, use the descriptive search mode to locate the applicable cell pages.

Step 7: If suitable data cannot be located by reference to the functional group summary cells in other matrices, the user should restructure the problem task to use data at a different taxonomy level.

Step 8: If suitable data cannot be found using the descriptive or ad hoc search modes, contact the NUCLARR Data Clearinghouse for assistance.

12.2 Hardware Component Failure Data

Step 1: Define the problem for which either a failure rate or a failure on demand probability is sought. This entails identifying the component and its design, the failure mode of interest, and associated factors, such as the system the component resides in and associated application factors.

Step 2: Identify the most relevant component type, design, and failure mode from the categories for these attributes available in NUCLARR (see Vol. IV, Part 3, Section 4.1.3 and Appendix F).

Step 3: Access NUCLARR and locate the records having the desired event attributes. If there are no such records, go to Step 7. Select the plot option and view the amount of variety present among the failure rates or probabilities. If there is little variation, use the aggregated value from these data. (Often this will be NUCLARR's precomputed aggregated value.)

Step 4: If there is variation, further actions depend on the amount of data present. If there are few records, view them and seek a single record or subset that has associated attributes such as normal state, system, plant, and application codes that match the situation being modeled. [Normal states are described in Volume IV, Part 3, Section 4.1.4; system codes are in Appendix I, plant codes in Appendix H, and possible applications are in Appendix G of Volume IV, Part 3.]

Step 5: A variety of options exist for narrowing down the record set. For records obtained in a descriptive search or brought in from a file using the main descriptive search menu, a tailored search is available. This allows one to select only nuclear data, only data for safety-grade components, only plant-specific data, only primary failure data, only U.S. domestic data, and/or only data that have a data quality flag set (see Vol. IV, Part 3, Section

attributes. This is an iterative process involving successive narrowing of the selected data and review of the results. It results in the selection of a single data point or aggregation average for use by the risk analyst.

Step 6: If during Step 3 or Step 5 a plot shows a particular data point to be an apparent outlier, the point can be omitted using the unselect option while viewing the summary screen for the data point. The user should know why the point is atypical and would not apply to the identified problem before excluding it. In the future, review of the notes associated with the record, if any, might help with this decision.

Step 7: If no records are initially identified, one should consider whether records from the design unknown subgroup of data for the component of interest might apply. The evaluation of these records would be similar to Steps 3 through 6 above.

Step 8: If this fails, one should consider the general component type (e.g., motor-operated pumps) without concern for the design. Again, perform an evaluation as described in Steps 3 through 6.

Step 9: If this fails, consider whether data describing a greater variety of failure modes might still adequately represent the desired failure rate. For example, instead of seeking data for spurious closure, seek data for spurious operation. The failure mode group level of data may provide an adequate average and upper bound for the desired failure rate.

Step 10: If Step 9 fails, consult the NUCLARR Data Clearinghouse for assistance.

13. DOCUMENT FILE/SOURCE CATALOG

Bibliographic data for all source documents from which NUCLARR source data were obtained are stored and maintained in the on-line NUCLARR system document file. This feature gives the data requester immediate access to the title, authors, publisher, and other identifying information, such as where the data values were derived. The document identification number from the data records is cross-referenced with the citations from the document file.

14. PRACTICE AND REVIEW: TUTORIAL

A series of examples for retrieving data have been prepared to acquaint the user with the various features of the NUCLARR system discussed in the previous sections. The examples are representative of typical problems that may be encountered by the user when tasked with the need to derive data inputs to a risk analysis activity. A total of four examples are presented, depicting the implementation of the descriptive and ad hoc search modes for HEP and HCFD.

These examples are presented in Appendix A. It is suggested that, after installation of the software has been successfully accomplished, these examples be followed and fully understood by the user prior to using the NUCLARR system as a risk analysis tool.

15. REFERENCES

1. K. D. Russell and M. B. Sattison, Integrated Reliability and Risk Analysis System (IRRAS) User's Guide - Version 2.0, EGG-2535, NUREG/CR-5111, March 1988.

2. W. W. Tullock, M. B. Sattison, V. S. Van Siclen, System Analysis and Risk Assessment System (SARA) User's Manual, EGG-2522, NUREG/CR-5022 (DRAFT), September 1987.

3. M. R. Groh, W. J. Galyean, C. D. Gentillon, Requirements for Entry of Component Failure Data in NUCLARR, EGG-REQ-7742, October 1987.

APPENDIX A

EXAMPLE DATA RETRIEVAL PROBLEMS

APPENDIX A

EXAMPLE DATA RETRIEVAL PROBLEMS

The following examples are used to illustrate the search and retrieval capabilities using ad hoc and descriptive searches for both human error probability (HEP) and hardware component failure data (HCFD). Completing the practical exercises is optional, but we urge you to at least study them to give you an idea of the kinds of problems that can be addressed using the NUCLARR system.

The examples are presented in a step-by-step format and are preceded by instructions and a brief hypothetical scenario. Read the scenario description and follow the instructions. Figures of many of the displays that accompany the instructions have been included. Refer to these figures when indicated to do so by the instructions. Directions for the user to use the keyboard or issue commands are underlined (e.g., Press the space bar). When you come across an underlined statement, it is a direction to you to interact with the program. At any point in the dialog, the <escape> key may be pressed to receive additional HELP information. If you have any questions, address them to the NUCLARR Data Clearinghouse.

Example 1: Locate an HEP by a Descriptive Search

You are sitting in your office while reviewing a PRA from a Babcock & Wilcox plant. You have been asked to review the utility's treatment of human actions for a small break LOCA sequence. In particular, someone has indicated to you that the sequence is dominated by operator failure to initiate HPI. The utility indicates that there is a probability of 2.0×10^{-5} for operator failure. Your task is to evaluate the utility's HEP in light of the data present in NUCLARR. (Assume for this and all the other examples that the method for determining the HEP is not significant to your task.)

Instructions: Conduct a descriptive (cell by cell) search of the HEP data base for the following task: Operator fails to initiate HPI during a small LOCA sequence.

Step	Description
1.1	Load the NUCLARR retrieve program into computer memory. Type NUCLARR, then press [Enter].
1.2	At the NUCLARR Main Menu (Figure A-1), use the space bar or arrow keys to move the highlighted bar to option 1, "Human Reliability Data." Then press [Enter].
1.3	At the Main Retrieve Menu (Figure A-2), select option 1, "Locate HEP Data Records by Description."
1.4	At the next menu (Figure A-3), select option 1. This indicates a taxonomy Level 1 or Plant Systems search.
1.5	The next menu (Figure A-4) is used to identify the job title of the person performing the specified action. In this case, it is the control room operator, so select option 1 from this menu.
1.6	The following menu (Figure A-5) is used to specify the NSSS vendor whose plant systems the operator is interacting with. In this case, it is a Babcock & Wilcox plant, so select option 4 from this menu.
1.7	The next menu displayed (Figure A-6) allows you to select the equipment group that you want to search (take a moment to review the equipment groups). Select the Emergency Core Cooling Systems group, equipment code 090.

NUclear Computerized Library for Assessing Reactor Reliability
Main Menu
Version 1.1

Q - Quit NUCLARR System
? - NUCLARR Hotline #

1 - Human Reliability Data
2 - Hardware Failure Data
3 - HEP Aggregation Help File
4 - Hardware Aggregation Help File

Figure A-1. NUCLARR Main Menu for HEP data.

Retrieval of
NUclear Computerized Library for Assessing Reactor Reliability
Human Error Probability Data

Main Retrieve Menu
Version 1.1

E - Exit from HEP Retrieve Program
? - NUCLARR Hotline #

1 - Locate HEP Data Records by Description
2 - Review Documents
3 - Locate HEP Data Records by Ad Hoc Search
4 - Report on Located HEP Data Records
5 - Plot from Located HEP Data Records
6 - Calculate Aggregated HEP for Located Records
7 - Generate ASCII File for dBase III/SAS/SPSS
8 - Retrieve a Saved Data Records File
9 - Save Located Records to a File

Figure A-2. NUCLARR Main Retrieve Menu for HEP data.

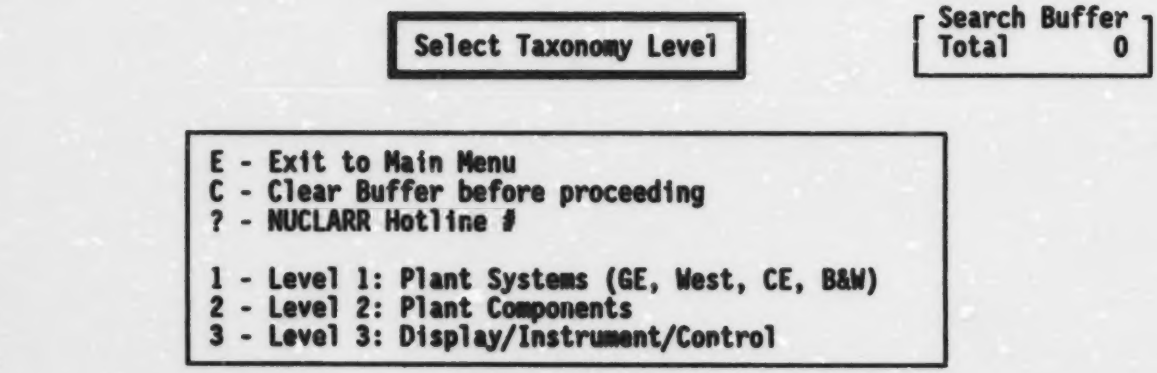

Select Taxonomy Level
Search Buffer
Total 0
E - Exit to Main Menu
C - Clear Buffer before proceeding
? - NUCLARR Hotline #
1 - Level 1: Plant Systems (GE, West, CE, B&W)
2 - Level 2: Plant Components
3 - Level 3: Display/Instrument/Control

Figure A-3. NUCLARR Select Taxonomy Level menu.

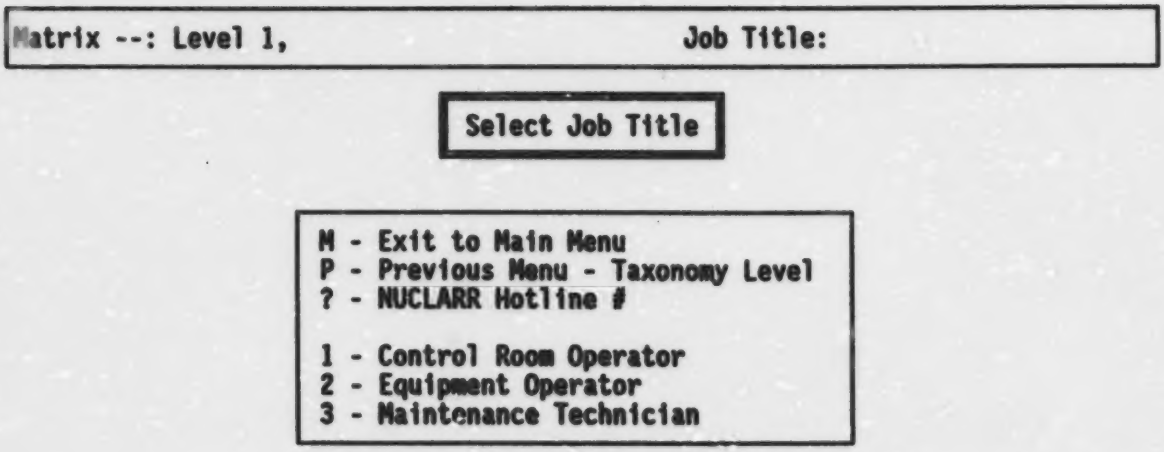

Matrix --: Level 1,
Job Title:
Select Job Title
M - Exit to Main Menu
P - Previous Menu - Taxonomy Level
? - NUCLARR Hotline #
1 - Control Room Operator
2 - Equipment Operator
3 - Maintenance Technician

Figure A-4. NUCLARR Select Job Title menu.

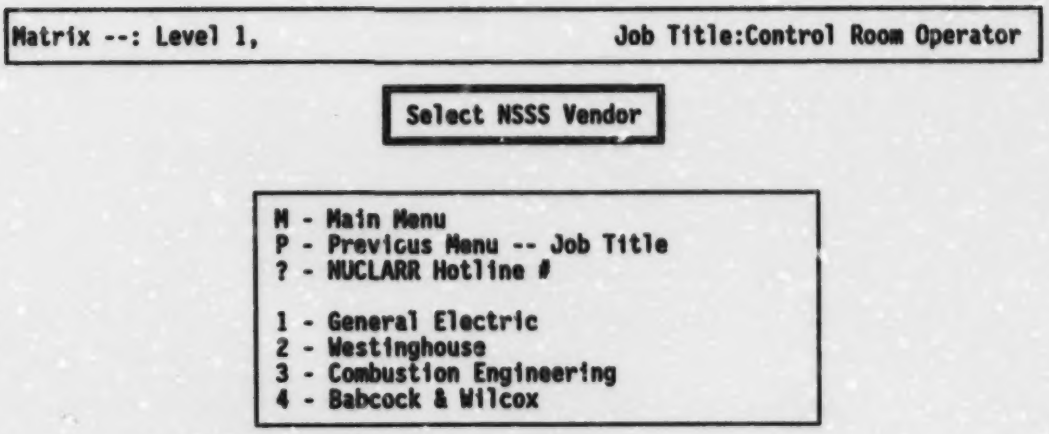

Matrix --: Level 1,
Job Title:Control Room Operator
Select NSSS Vendor
M - Main Menu
P - Previous Menu -- Job Title
? - NUCLARR Hotline #
1 - General Electric
2 - Westinghouse
3 - Combustion Engineering
4 - Babcock & Wilcox

Figure A-5. NUCLARR Select NSSS Vendor menu.

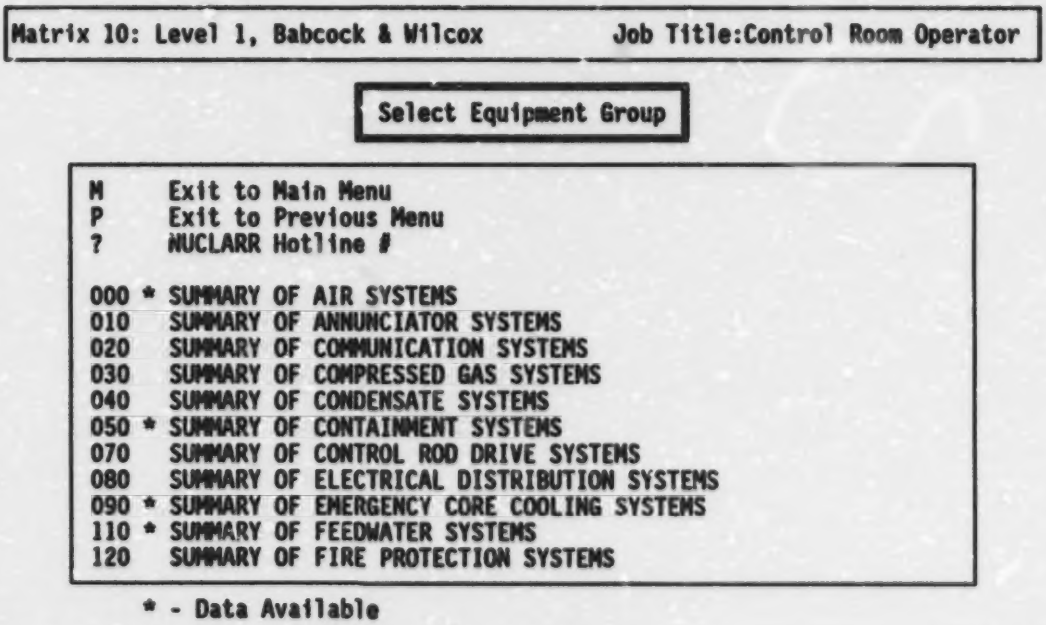

Matrix 10: Level 1, Babcock & Wilcox
Job Title:Control Room Operator
Select Equipment Group
M Exit to Main Menu
P Exit to Previous Menu
? NUCLARR Hotline #
000 * SUMMARY OF AIR SYSTEMS
010 SUMMARY OF ANNUNCIATOR SYSTEMS
020 SUMMARY OF COMMUNICATION SYSTEMS
030 SUMMARY OF COMPRESSED GAS SYSTEMS
040 SUMMARY OF CONDENSATE SYSTEMS
050 * SUMMARY OF CONTAINMENT SYSTEMS
070 SUMMARY OF CONTROL ROD DRIVE SYSTEMS
080 SUMMARY OF ELECTRICAL DISTRIBUTION SYSTEMS
090 * SUMMARY OF EMERGENCY CORE COOLING SYSTEMS
110 * SUMMARY OF FEEDWATER SYSTEMS
120 SUMMARY OF FIRE PROTECTION SYSTEMS
* - Data Available

Figure A-6. NUCLARR Select Equipment Group menu.

Step	Description
1.8	The next display (Figure A-7) presents the equipment available for search under the Emergency Core Cooling Systems group. Select the High Pressure Safety Injection System, equipment code 092.
1.9	NUCLARR will next present a list of human actions categories for you to select from (Figure A-8). Select Operates from this list, human action code 01.
1.10	The menu following human actions (Figure A-9) is used to control the display or output of HEP information to your display or printer. You may look at the individual data records, a report without aggregated HEPs, or a report with aggregated HEPs. In this case, select option 3 to look at a report with aggregated HEPs.
1.11	The next screen (Figure A-10) allows you to choose where the report is sent--to the screen, the printer, or a file. In this case, type [CON] to see the report on the screen. Then press [Enter] to continue processing the report. Press the space bar to start the report.
1.12	Continue to press the space bar to page through the remainder of the report.
1.13	The next display (Figure A-11) is the HEP data which NUCLARR found during its search of the HEP data base. NUCLARR displays HEPs for omission and commission errors. At this point, you can evaluate the data to determine whether the value supplied by the utility's PRA is consistent with data in NUCLARR. As you can see, the cell HEPs in NUCLARR (.022 and .05) differ from the utility's estimate by approximately three orders of magnitude. Note that RC and RNC refer to whether or not recovery has been

Matrix 10: Level 1, Babcock & Wilcox Job Title:Control Room Operator

Select Equipment Group

```
M     Exit to Main Menu
P     Exit to Previous Menu
?     NUCLARR Hotline #

090 * SUMMARY OF EMERGENCY CORE COOLING SYSTEMS
091 * Emergency Core Cooling Systems
092 * High Pressure Safety Injection System
093 * Decay Heat Removal/Core Flooding System
094 * Decay Heat Removal/Low Pressure Safety Injection System
```

* - Data Available

Figure A-7. NUCLARR Select Equipment Group submenu.

Matrix 10: Level 1, Babcock & Wilcox Job Title:Control Room Operator

Equipment Class: High Pressure Safety Injection System

Select Human Action

```
M     Exit to Main Menu
P     Exit to Previous Menu
?     NUCLARR Hotline #

00    TESTS
01  * OPERATES
02    MONITORS
03    DIAGNOSES
```

* - Data Available

Figure A-8. NUCLARR Select Human Action menu.

Taxonomy Level: 1
Matrix: 10

Page Number:-1009201

Job Title: Control Room Operator
Human Action Verb: OPERATES
Equipment Class: High Pressure Safety Injection System
NSSS Vendor/Equipment Level: Babcock & Wilcox
above describes Last Search request

Data Display Options

Records Located
Last Search 7 Total =7

M - Main Menu
P - Previous Menu -- Action Verbs
C - Clear Buffer instead of proceeding
? - NUCLARR Hotline #

1 - View Located Records
2 - Report without aggregated HEPs
3 - Report with aggregated HEPs

Figure A-9. NUCLARR Data Display Options menu.

Write Requested Report

of

Located HEP Data Records

on

Output device : [ ]

PRN - printer
COM - display
filename.ext - file

COMMAND [S]: Exit Start ? hotline #

Figure A-10. NUCLARR Write Requested Report screen.

Taxonomy Level: 1
Matrix: 10 Page Number: 1009201

Job Title: Control Room Operator
Human Action Verb: OPERATES
Equipment Class: High Pressure Safety Injection System
NSSS Vendor/Equipment Level: Babcock & Wilcox

Cell HEPs (combined from Task HEPs)

Omission Error:						
Recovery Considered	Median:	.0226793	UCB:	.0584595	LCB:	.0087984
	Mean:	.0283461	EF:	3		
Commission Error:						
Recovery Considered	Median:	.0500000	UCB:	.5000000	LCB:	.0050000
	Mean:	.1331916	EF:	10		

Strike space-bar to continue, <Enter> for return to selection menu

Figure A-11. NUCLARR HEP data display.

Step	Description

considered in the HEP estimates. Here, recovery was considered. The HEPs also have upper (UCB) and lower (LCB) confidence bounds.

1.14 The next menu that comes up is the Data Display Options menu (Figure A-9). Since you are through with the descriptive search, select Main Menu. Then press [Enter]. This will return you to the HEP Main Retrieve Menu (Figure A-2), which is where you should be to start Example 2.

Example 2: Locate HEP data by Ad Hoc Search

A utility reports in its PRA or other safety evaluation that exact HEPs for a task involving an equipment operator were not calculated. Instead, they used a screening value of .002 for all tasks in which an equipment operator performed an error of omission in conjunction with plant equipment. In addition, the PRA does not address whether recovery from the error was considered. You want to see for yourself whether this is a credible screening value, or whether there is a more appropriate screening value which could have been used. Using NUCLARR, you can perform such an ad hoc search.

Instructions: Obtain an HEP for omission errors by equipment operators for all kinds of tasks with all kinds of plant equipment.

Step	Description

2.1 At the NUCLARR Main Retrieve Menu (Figure A-2), select option 3, "Locate HEP Data Records by Ad Hoc Search." This will get you to the screen from which you can enter your search criteria.

2.2 Let's take a moment to look at this next screen of information (Figure A-12). At the top of the display, there is a box that indicates the purpose of this screen: Locate data records.

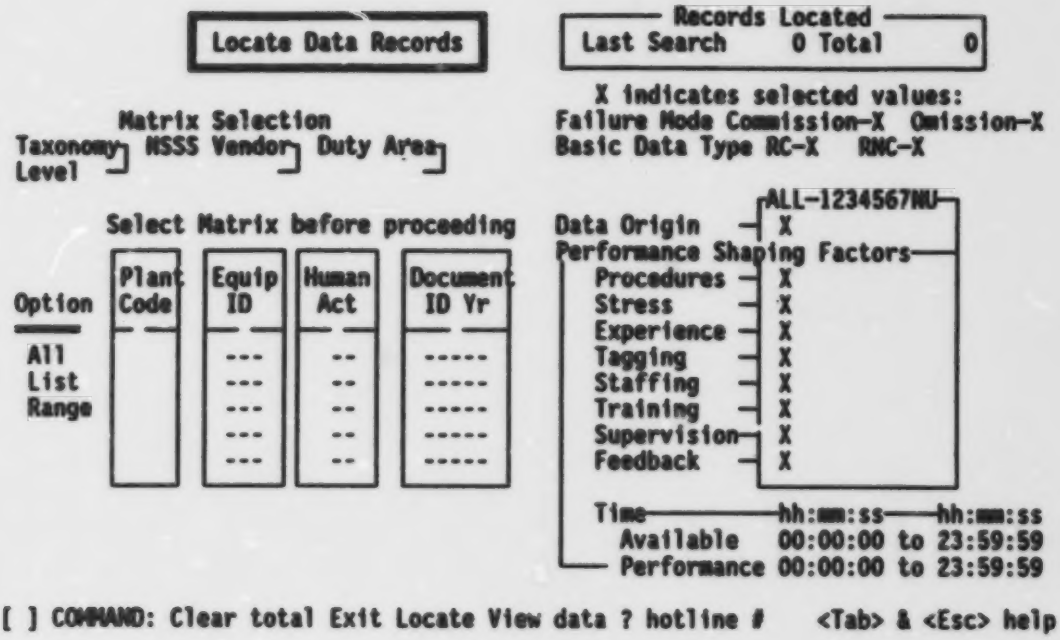


Figure A-12. NUCLARR HEP Locate Data Records screen.

Step	Description

Directly to the right of this box there is another box, labeled "Records Located" (no quotation marks). Every time you perform a search of the HEP data base, a "buffer" (a storage area in the computer's memory) is filled with the records retrieved by the data search. For each subsequent search, more records are added to the buffer. That's okay if you want to build a report of HEP data records, but if you really want only the records from a particular HEP data search then you need to clear the buffer before your search. This protects you from inadvertently mixing records from one search with records from another search. To clear the search buffer, first press the [Home] key. This puts the cursor in the command box ([ ]) at the bottom left of the display. Next, press the letter [C] (for Clear) on your keyboard, then press the [Enter] key. After the buffer has been cleared, NUCLARR will display the message "Search buffer has been cleared" at the bottom of the display. You are now ready to begin your data search.

2.3 Since the screening value of interest deals with plant components, initiate a taxonomy Level 2 search. To do this you will have to use the arrow keys located to the right of your letter keys. Press the down arrow once to move the cursor to "matrix selection." Next press [Esc]. A taxonomy level selection HELP menu (Figure A-13) will appear. Use the down arrow key or space bar to select Option 2. Press [Enter].

2.4 The next menu to appear will be the Duty Area Selection menu (Figure A-14). To select records for equipment operators, position the highlighted bar on the option labeled "EO" and press [Enter].

2.5 The next field that appears on the menu (Figure A-12), for NSSS vendor, is not a required search field for Level 2 (Components)

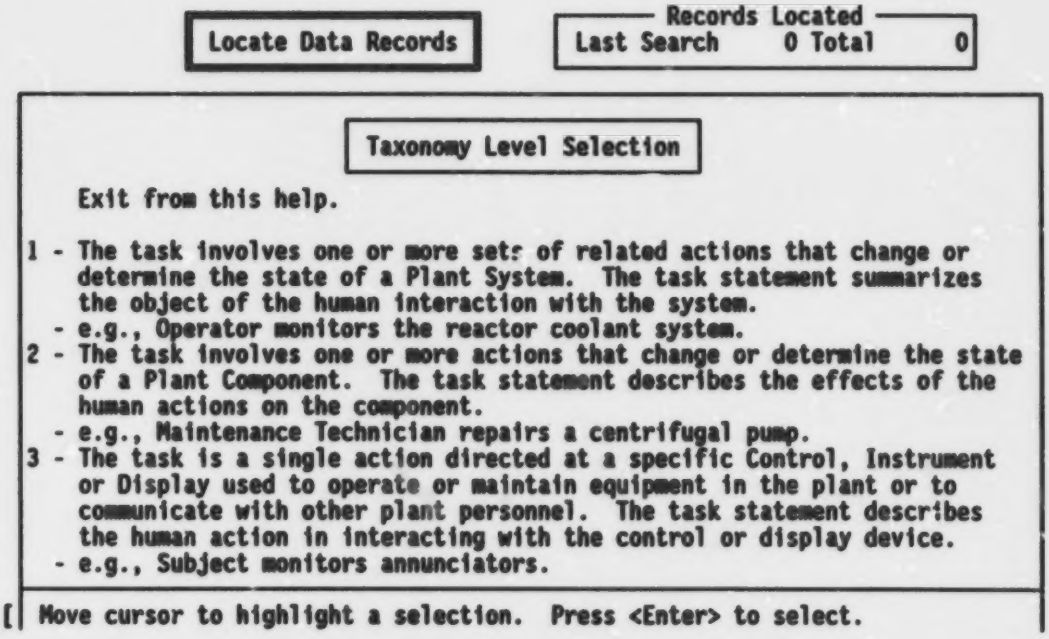

Locate Data Records
Records Located
Last Search 0 Total 0
Taxonomy Level Selection
Exit from this help.
1 - The task involves one or more sets of related actions that change or determine the state of a Plant System. The task statement summarizes the object of the human interaction with the system.
- e.g., Operator monitors the reactor coolant system.
2 - The task involves one or more actions that change or determine the state of a Plant Component. The task statement describes the effects of the human actions on the component.
- e.g., Maintenance Technician repairs a centrifugal pump.
3 - The task is a single action directed at a specific Control, Instrument or Display used to operate or maintain equipment in the plant or to communicate with other plant personnel. The task statement describes the human action in interacting with the control or display device.
- e.g., Subject monitors annunciators.
Move cursor to highlight a selection. Press <Enter> to select.

Figure A-13. NUCLARR HEP Taxonomy Level Selection screen.

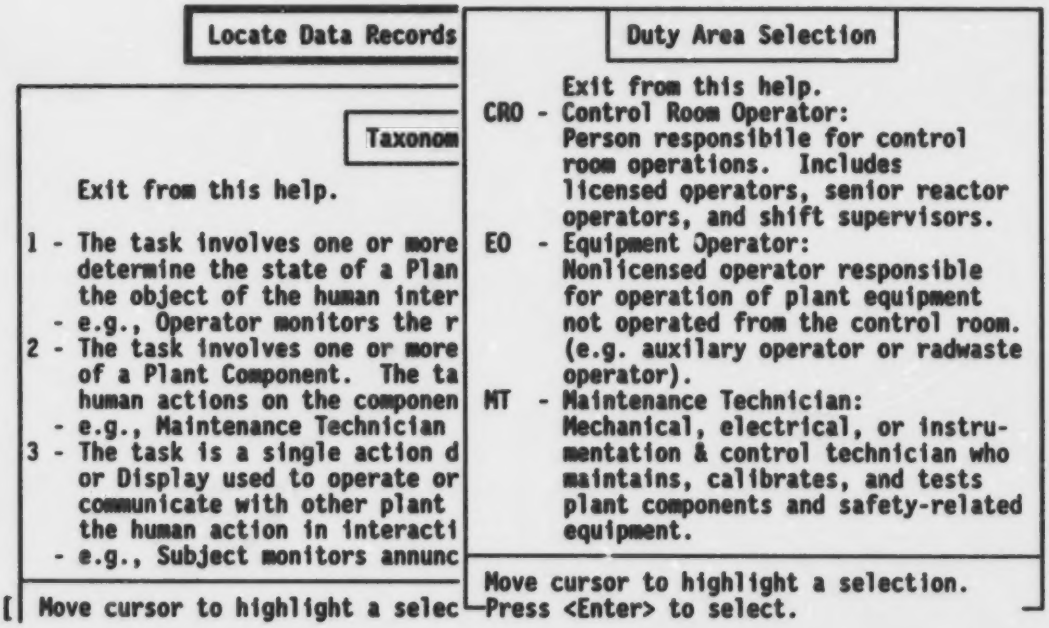

Locate Data Records
Taxonom
Exit from this help.
1 - The task involves one or more
determine the state of a Plan
the object of the human inter
- e.g., Operator monitors the r
2 - The task involves one or more
of a Plant Component. The ta
human actions on the componen
- e.g., Maintenance Technician
3 - The task is a single action d
or Display used to operate or
communicate with other plant
the human action in interacti
- e.g., Subject monitors annunc
Move cursor to highlight a selec
Duty Area Selection
Exit from this help.
CRO - Control Room Operator:
Person responsibile for control room operations. Includes licensed operators, senior reactor operators, and shift supervisors.
EO - Equipment Operator:
Nonlicensed operator responsible for operation of plant equipment not operated from the control room. (e.g. auxilary operator or radwaste operator).
MT - Maintenance Technician:
Mechanical, electrical, or instrumentation & control technician who maintains, calibrates, and tests plant components and safety-related equipment.
Move cursor to highlight a selection.
Press <Enter> to select.

Figure A-14. NUCLARR Duty Area Selection screen.

Step	Description

or Level 3 (Controls/Instruments/Displays), and in any searches initiated below Level 1 the field for NSSS vendor can be left blank. For this problem, we have no reason to believe that equipment operators at one plant (e.g., B&W, W, CE, GE) make more errors in operating components than at another. In addition, since we are only looking for a representative screening value, a search at Level 2, which doesn't distinguish between NSSS vendors, is perfectly appropriate for this application.

2.6 The next search criterion is Plant Code. To make a selection for this criterion, position your cursor on the top line of this box just below the word Code by pressing the down arrow. There are three optional search strategies for this and the other three boxes in this group: All, List, and Range. Selecting All (by entering [A] in the broken top line of this box) will cause NUCLARR to search through data from all the plants in the data base. Selecting List (by entering [L] in the top line of this box) permits you to search through a subset or list of the plants from the data base. Selecting Range (by entering [R] in the top line of this box) would restrict your search of the data base to a range of values that you specify.

2.7 Select All for the plant code by pressing the letter [A] in the field for plant code.

2.8 Using the arrow keys, select All for Equipment ID, Human Action, and Document ID Year. This tells NUCLARR to look through all equipment records, to include all human actions, and to use data available from all years in the data base. IF INFORMATION IS ENTERED INTO A FIELD INNACCURATELY, USE THE LEFT ARROW TO LEFT-JUSTIFY THE CURSOR, THEN PRESS [CTRL][END] TO CLEAR THE FIELD. (See Section 4, Glossary of Frequently Used Commands.)

Step	Description

2.9 Next, use the arrow keys to move the cursor to the upper right of the screen. Press [Esc] to bring up the Failure Mode Selection HELP menu (Figure A-15). Select Option 2, "Omission" because we are interested only in errors of omission. Press [Enter], move the cursor to option E (for "Exit"), then press [Enter] again.

2.10 Beneath the labels for failure mode are two fields for the basic data type. RC stands for recovery considered, and RNC stands for recovery not considered. Recovery refers to the idea that some errors can be corrected if the person performing the action recognizes that his or her action is incorrect. Since the utility did not address recovery in its treatment of the screening value, we should search through both types of data records. Move the cursor to "Basic Data Type" and press [Esc]. The Basic Data Type Selection HELP menu (Figure A-16) will appear. Select Option 1, then press [Enter]. An X will be placed in he box opposite RC. So that NUCLARR will search through both data type records, now select Option 2 and press [Enter]. An X is placed in the field for RNC. Select E, then press [Enter] to return to the Locate Data Records screen.

2.11 Below these criteria is a matrix. Across the top of the matrix is a scale for specifying the level or degree of the categories along the side of the matrix that you wish to include in your search. The scale for Data Origin refers to the type of human reliability method used to generate the HEPs (e.g., field data, simulator data, etc.). If you want data from only certain types of HRA methods, you can specify these here. For our purposes, we will use data from all types of HRA methods. Since ALL has been preselected by NUCLARR, do nothing for this field.

2.12 The next part of the matrix contains information about Performance Shaping Factors (PSF) beginning with Procedures and

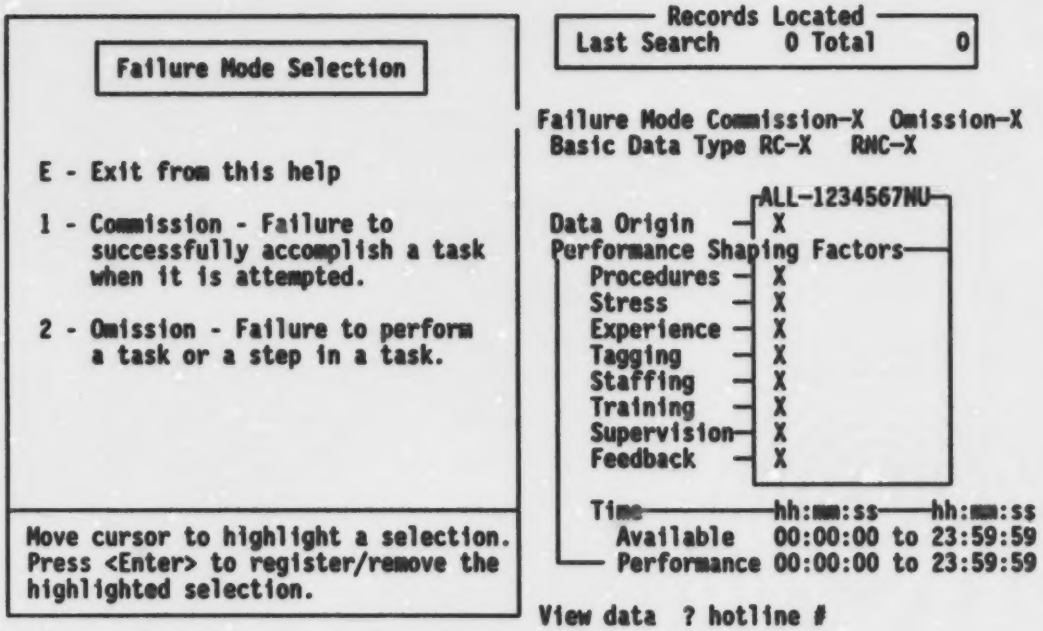

Failure Mode Selection
E - Exit from this help
1 - Commission - Failure to successfully accomplish a task when it is attempted.
2 - Omission - Failure to perform a task or a step in a task.
Move cursor to highlight a selection. Press <Enter> to register/remove the highlighted selection.
Records Located
Last Search 0 Total 0
Failure Mode Commission-X Omission-X
Basic Data Type RC-X RNC-X
ALL-1234567NU
Data Origin X
Performance Shaping Factors
Procedures X
Stress X
Experience X
Tagging X
Staffing X
Training X
Supervision X
Feedback X
Time hh:mm:ss hh:mm:ss
Available 00:00:00 to 23:59:59
Performance 00:00:00 to 23:59:59
View data ? hotline #

Figure A-15. NUCLARR Failure Mode Selection screen.

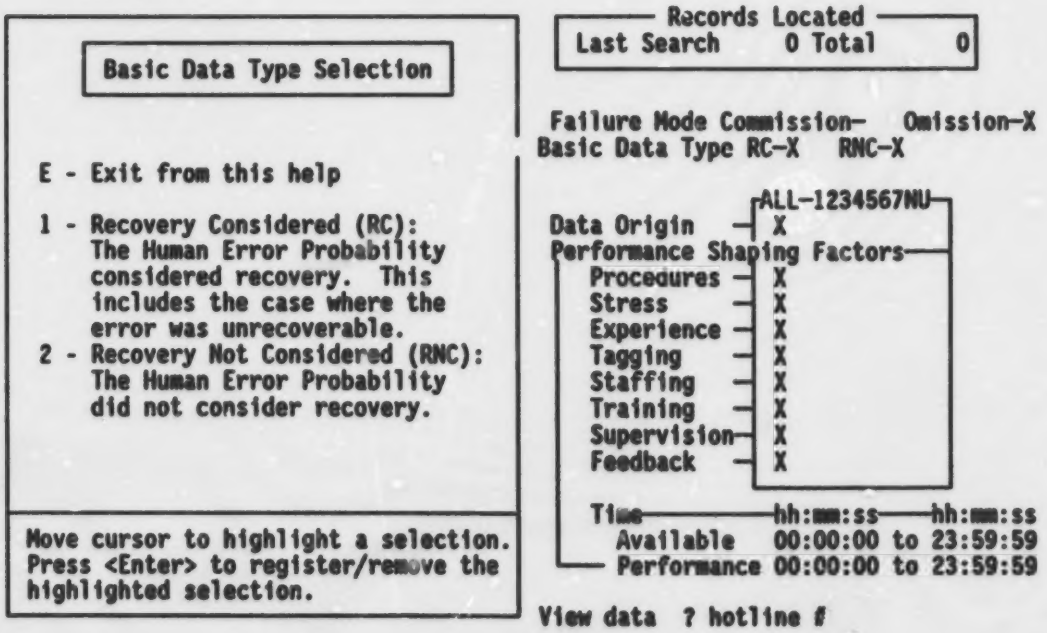

Basic Data Type Selection
E - Exit from this help
1 - Recovery Considered (RC): The Human Error Probability considered recovery. This includes the case where the error was unrecoverable.
2 - Recovery Not Considered (RNC): The Human Error Probability did not consider recovery.
Move cursor to highlight a selection. Press <Enter> to register/remove the highlighted selection.
Records Located
Last Search 0 Total 0
Failure Mode Commission- Omission-X
Basic Data Type RC-X RNC-X
ALL-1234567NU
Data Origin X
Performance Shaping Factors
Procedures X
Stress X
Experience X
Tagging X
Staffing X
Training X
Supervision X
Feedback X
Time hh:mm:ss hh:mm:ss
Available 00:00:00 to 23:59:59
Performance 00:00:00 to 23:59:59
View data ? hotline #

Figure A-16. NUCLARR Basic Data Type Selection screen.

Step	Description

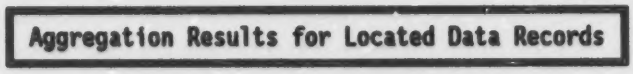
ending with Feedback. Placing an [X] in the numbered columns for the PSFs provides a rating of the PSFs for the HEP (e.g., a rating of 4 for Stress indicates a highly stressful work environment, such as during a severe accident). Since NUCLARR preselects ALL, you can skip these fields for the present example.

2.13 The last area of the screen at the lower right is for the time available to perform the action, and the time taken to perform the action. These fields, for Time Available and Performance, are set up to accept time criteria within a range from 0 to 24 hours. (The actual maximum time that can be entered is 23 hours, 59 minutes, and 59 seconds.) If no values are entered, the Ad Hoc mode will default to search for all times within the maximum allowable range (0 to 24 hours). This area is used primarily with HRA methods based on time reliability curves. Since time is not a factor in this example, leave this area blank.

2.14 To begin the data search, press the [Home] key. This places the cursor in the command box at the lower left of the display. Next, press the letter [L] (for Locate) and the [Enter] key. This tells NUCLARR to begin its search of the HEP data base for records using the criteria that we have specified.

2.15 When NUCLARR has finished its search, it will indicate how many records it found that match the criteria we gave it. Press [E] (for Exit) followed by the [Enter] key. This puts you back at the NUCLARR Main Menu, where you can aggregate the HEPs as well as view the data records.

2.16 Select option 6, "Calculate Aggregated HEP for Located Records" and press [Enter]. Within a short time, NUCLARR will come back with a prepared screen presenting you with the aggregated value and its confidence bounds (Figure A-17). If NUCLARR comes back



Functional (Median based on Geometric Average)

HEP : .0168293

UCB : .0406836

LCB : .0069617

user-supplied description of located records

COMMAND [ ]: Exit Report ? hotline #

Figure A-17. NUCLARR Aggregation Results for Located Data Records screen.

81

Step	Description

with several values and their confidence bounds, it means that the HEPs are too different and cannot be aggregated. However, if you desire to continue, you will be requested to select one of these values, with its bounds, as representative of the group. Once you have viewed the records, you can compare them with the utility's screening value to determine whether the two agree, or whether there is a discrepancy. Entering [E] (for Exit) from this screen will let you return to the main menu for HEP data.

2.17 You may obtain a report of the data records by selecting option 4 at the Main Menu, "Report on Located HEP Data Records." NUCLARR next gives you the option of viewing the report on your display, receiving a printed report, or saving it to a file (Figure A-10). For our example, type [con] (no brackets), then press [Enter] to view the report on the screen. You will be asked to input a description. Leave this field blank and press [Enter]. Press the space bar to page through the report.

2.20 You can get a plot of the data points by selecting option 5, "Plot from Located HEP Data Records," on the Main Retrieve Menu. Try this now. Type [N] if you have a monochrome monitor. Press the down arrow key to put the cursor in the command box. Type [P] and press [Enter]. You will notice that each data point is accompanied by confidence bounds.

Example 3: Locate Component Failure Data by Descriptive Search

Suppose that you are looking through an event sequence in which a pump failure is postulated. The normal backup for the pump is a standby motor-driven pump, and the event sequence postulates that this will also fail. This centrifugal pump is used for injecting borated water and, while normally in a standby mode, it fails to start on demand. The failure is not due to loss of power to the pump but rather is due to a mechanical fault.

Instructions: Determine the probability that the standby motor-driven pump fails to start on demand.

Step	Description
3.1	Load the NUCLARR retrieve software into the computer memory. Type [NUCLARR], then press [Enter].
3.2	At the NUCLARR Main Menu (Figure A-1), select Option 2. Type [2], then press [Enter].
3.3	At the Main Retrieve Menu for Hardware Data (Figure A-18), select option 1, "Locate Data Records by Description," by moving the highlighted bar; then press [Enter]. This selects the menu-driven search mode. After you have completed the descriptive search, any previously located records will be cleared out of the buffer and replaced by new ones.
3.4	At the next menu (Figure A-19), select option 2, "Begin Descriptive Search."
3.5	The next menu (Figure A-20) offers us a choice of hardware categories: mechanical and electrical. Select mechanical, option 1.
3.6	The next menu (Figure A-21) contains information about the types of components you can select for your search. The type of pump we are concerned with is the motor-driven pump. However, it does not appear on the screen. Other components can be viewed by pressing the [Page Down] or [PgDn] key to the right of the letter keys. To select this pump, press the [PgDn] key three times. Use the arrow keys or space bar to highlight the motor-driven pump (PPM 122) and press [Enter].

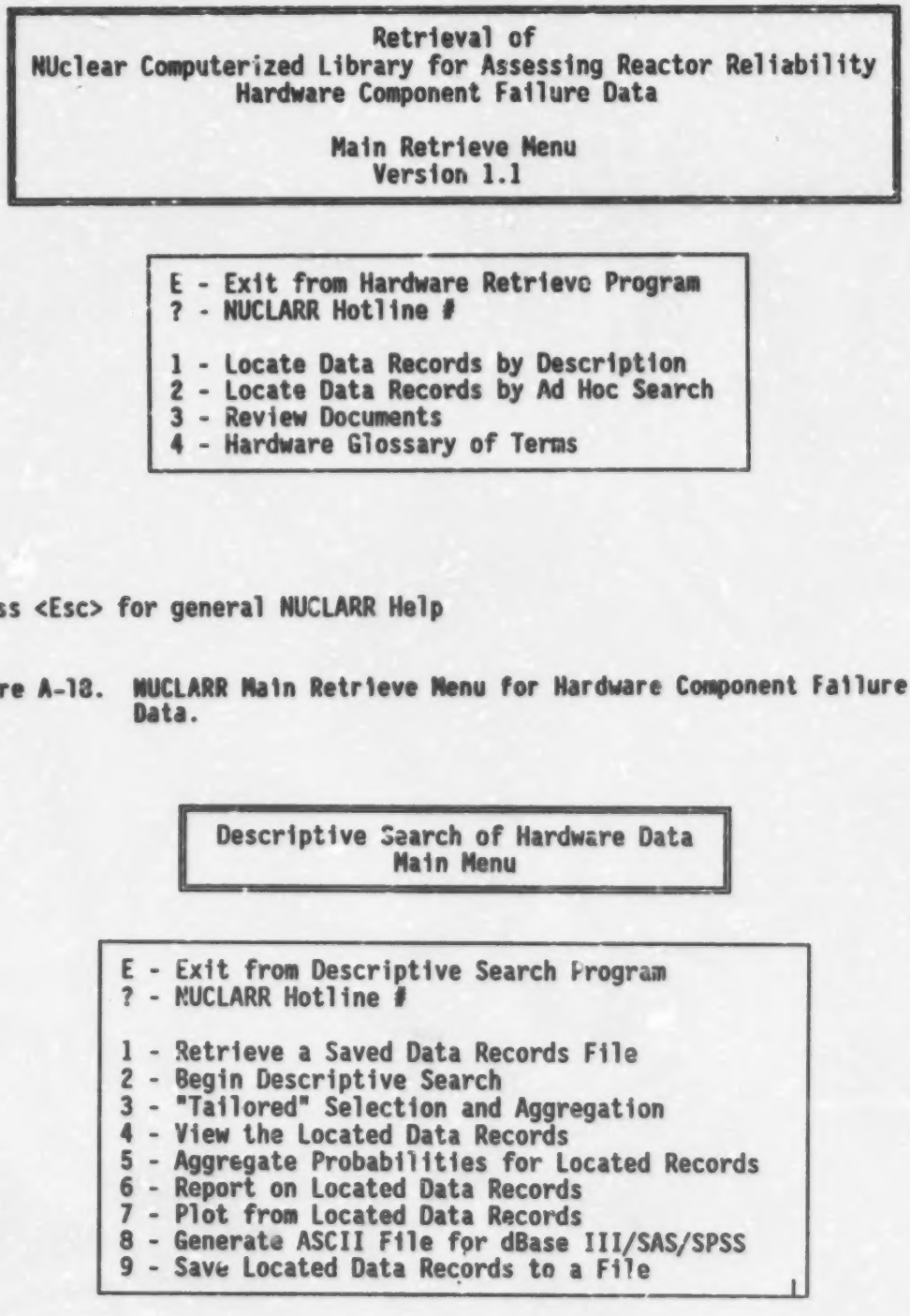

Retrieval of
NUclear Computerized Library for Assessing Reactor Reliability
Hardware Component Failure Data
Main Retrieve Menu
Version 1.1
E - Exit from Hardware Retrieve Program
? - NUCLARR Hotline #
1 - Locate Data Records by Description
2 - Locate Data Records by Ad Hoc Search
3 - Review Documents
4 - Hardware Glossary of Terms
Press <Esc> for general NUCLARR Help

Figure A-18. NUCLARR Main Retrieve Menu for Hardware Component Failure Data.

Descriptive Search of Hardware Data
Main Menu
E - Exit from Descriptive Search Program
? - NUCLARR Hotline #
1 - Retrieve a Saved Data Records File
2 - Begin Descriptive Search
3 - "Tailored" Selection and Aggregation
4 - View the Located Data Records
5 - Aggregate Probabilities for Located Records
6 - Report on Located Data Records
7 - Plot from Located Data Records
8 - Generate ASCII File for dBase III/SAS/SPSS
9 - Save Located Data Records to a File

Figure A-19. NUCLARR Main Menu for Descriptive Search of Hardware Data.

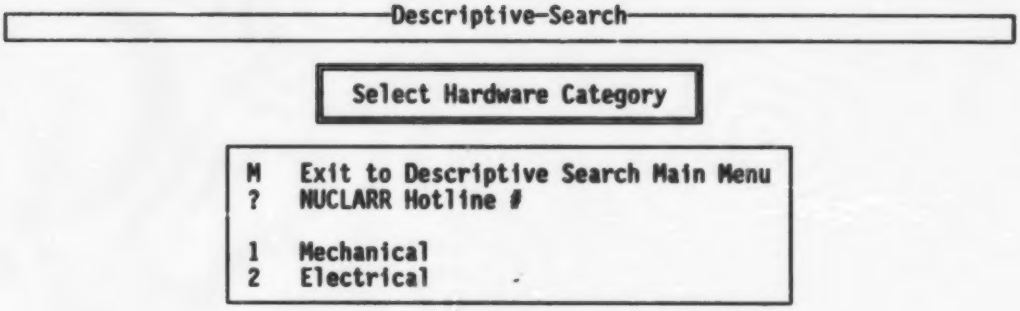


Figure A-20. NUCLARR Select Hardware Category menu.

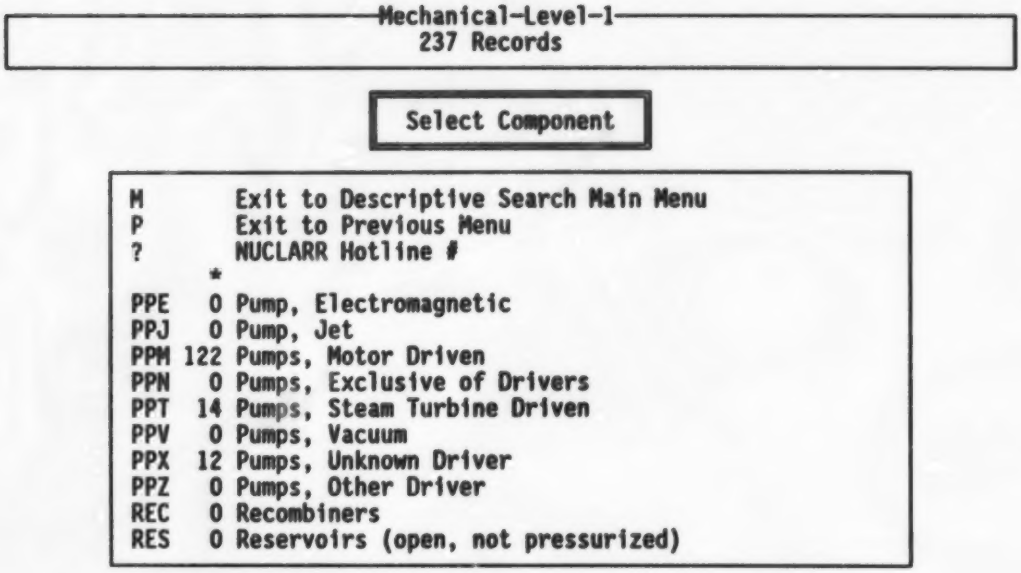

Mechanical-Level-1
237 Records
Select Component
M Exit to Descriptive Search Main Menu
P Exit to Previous Menu
? NUCLARR Hotline #
* *
PPE 0 Pump, Electromagnetic
PPJ 0 Pump, Jet
PPM 122 Pumps, Motor Driven
PPN 0 Pumps, Exclusive of Drivers
PPT 14 Pumps, Steam Turbine Driven
PPV 0 Pumps, Vacuum
PPX 12 Pumps, Unknown Driver
PPZ 0 Pumps, Other Driver
REC 0 Recombiners
RES 0 Reservoirs (open, not pressurized)
* Record Count

Figure A-21. NUCLARR Select Component menu.

Step	Description

3.7 The next menu (Figure A-22) refers to the kinds of equipment design. Since this is a centrifugal pump, select the third design option - centrifugal - from the design list using the arrow keys or space bar. Press [Enter].

3.8 The next menu (Figure A-23) is a little more complex. There are two menus on the same display: one for failure mode/normal state selection and another to specify the particular failure mode for the component. Move the highlighted bar in the upper box to highlight the option "Select Failure Mode" and press [Enter].

3.9 Once you have selected this option, the highlighted bar will move to the other menu box labeled "Failure Modes." To specify the failure mode, move the highlighted bar down the screen to highlight "Fails to Start" and press [Enter].

3.10 NUCLARR will now put a Normal State menu box on the screen and modify the upper menu box to include the option to "Select Normal State" (Figure A-24). Select this option from the menu.

3.11 When you have selected this option, your cursor will move to the menu box in the lower right of the display labeled Normal States. The normal mode for this pump is Standby. Move the highlighted bar to highlight the option "Normally Standby" and press [Enter].

3.12 The next menu displayed (Figure A-25) is "Select Applications." For pumps, this menu allows you to identify the internal environment(s) the pump is exposed to. The entire list of internal environments can be seen using the [PgDn] and [PgUp] keys. In this case, it is borated water. Move the cursor to highlight "Water, Borated Internal Environment" and press [Return]. [NOTE: You MUST select from ALL menus. If selection is stopped before "Applications," located records will not be saved in the storage buffer!]

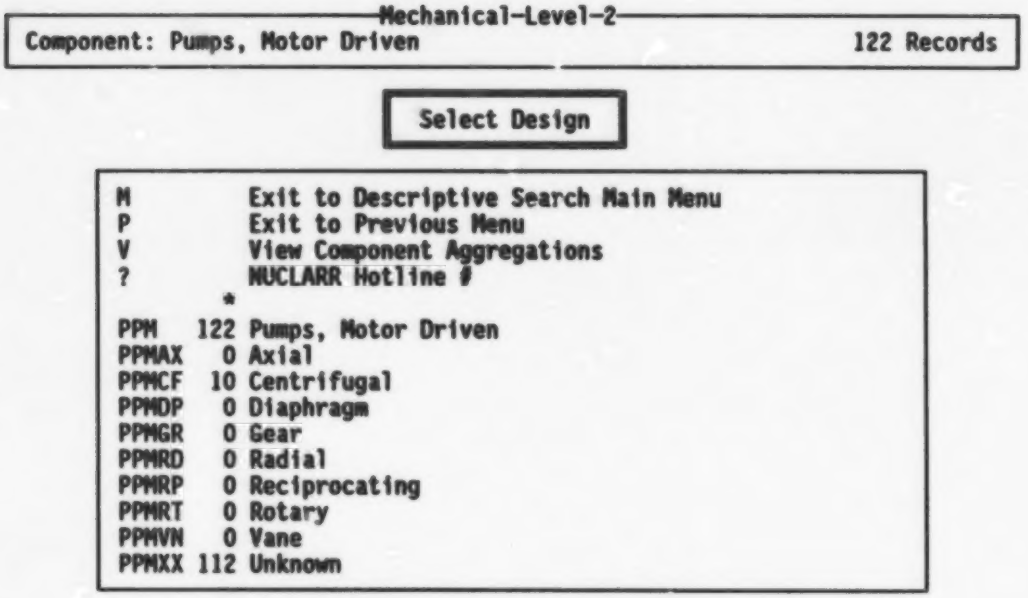


Figure A-22. NUCLARR Select Design menu.

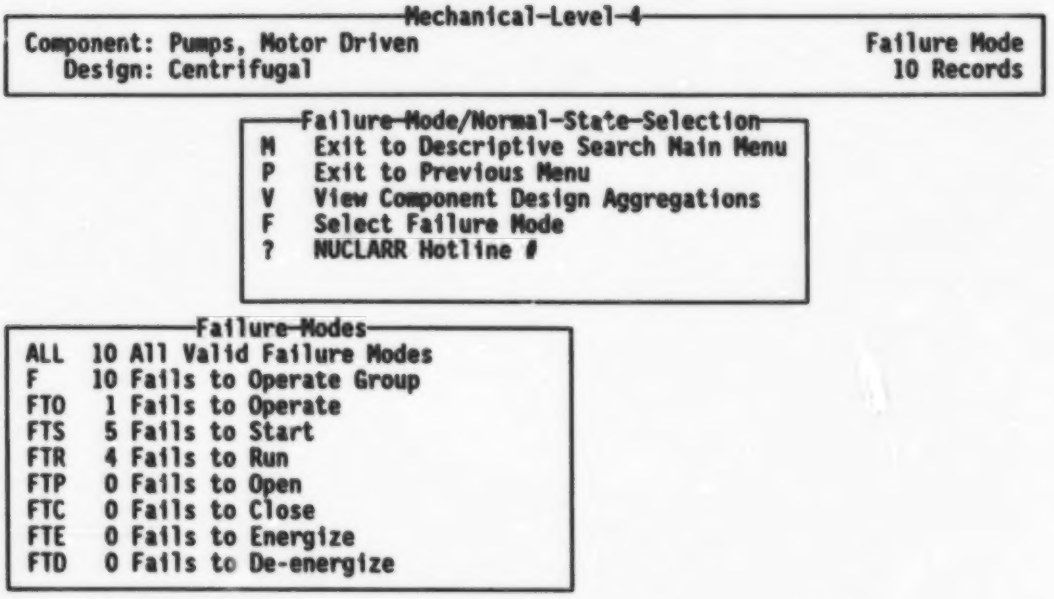

Mechanical-Level-4
Component: Pumps, Motor Driven
Design: Centrifugal
Failure Mode
10 Records
Failure-Mode/Normal-State-Selection
M Exit to Descriptive Search Main Menu
P Exit to Previous Menu
V View Component Design Aggregations
F Select Failure Mode
? NUCLARR Hotline #
Failure-Modes
ALL 10 All Valid Failure Modes
F 10 Fails to Operate Group
FTO 1 Fails to Operate
FTS 5 Fails to Start
FTR 4 Fails to Run
FTP 0 Fails to Open
FTC 0 Fails to Close
FTE 0 Fails to Energize
FTD 0 Fails to De-energize
* Record Count

Figure A-23. NUCLARR Select Failure Mode menu.

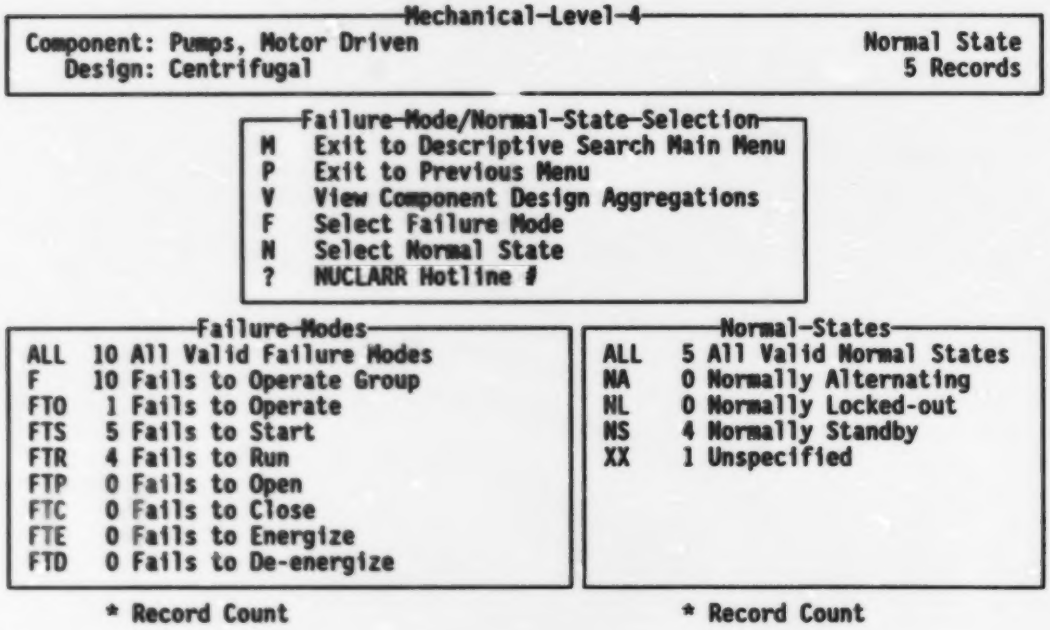


Figure A-24. NUCLARR Select Normal State menu.

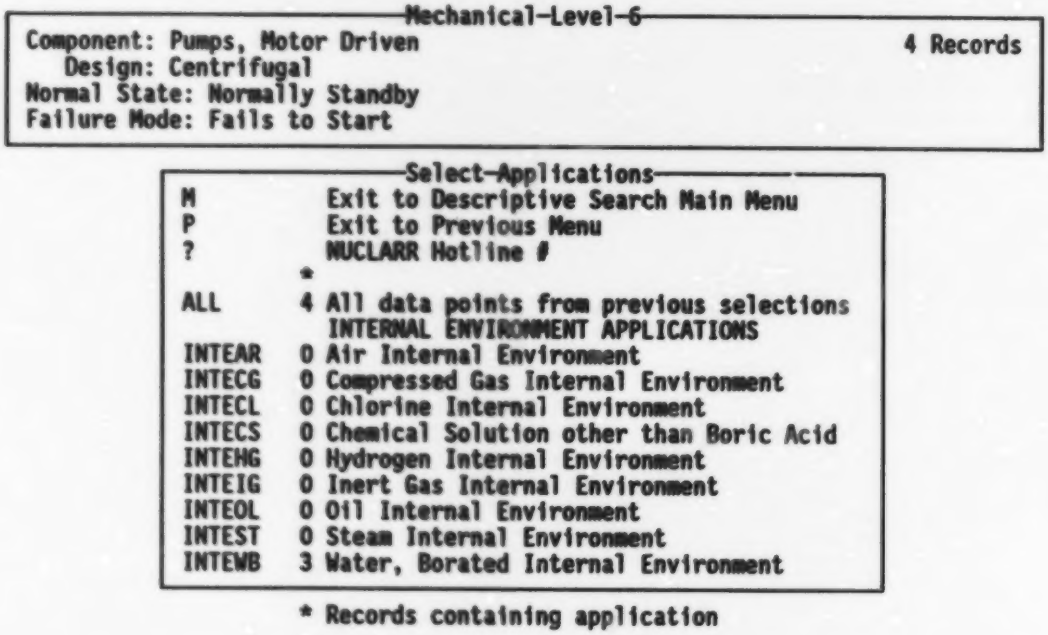

Mechanical-Level-6
Component: Pumps, Motor Driven
Design: Centrifugal
Normal State: Normally Standby
Failure Mode: Fails to Start
4 Records
Select-Applications
M Exit to Descriptive Search Main Menu
P Exit to Previous Menu
? NUCLARR Hotline #
*
ALL 4 All data points from previous selections
INTERNAL ENVIRONMENT APPLICATIONS
INTEAR 0 Air Internal Environment
INTECG 0 Compressed Gas Internal Environment
INTECL 0 Chlorine Internal Environment
INTECS 0 Chemical Solution other than Boric Acid
INTEHG 0 Hydrogen Internal Environment
INTEIG 0 Inert Gas Internal Environment
INTEOL 0 Oil Internal Environment
INTEST 0 Steam Internal Environment
INTEWB 3 Water, Borated Internal Environment
* Records containing application

Figure A-25. NUCLARR Select Applications menu.

Step	Description

3.13 You have now identified the important descriptive criteria for this item. NUCLARR next presents you with the menu for search buffer options (Figure A-26). Before viewing the events, they must be aggregated. Aggregate the data by selecting option 1 on this menu.

3.14 After aggregation is complete, highlight option 2 on the same menu and press the [Return] key.

3.15 The display shows the "Ad Hoc Event Aggregations" screen with the failure rate(s) for this component. To review a summary of the underlying data records, press [V] (to view data records) followed by [Enter]. This will call up a display (Figure A-27) showing the data record summary for the first record obtained during this search.

3.16 After you have reviewed the information on the data record summary, select the option to view a more detailed output, including the raw data for the record that is listed in the box at the top of the screen. To do this, press [V] and the [Return] key. This will call up a display of the data record (Figure A-28).

3.17 After viewing the raw data, press [Enter] to return to the Data Record Summary. To view the next data record, press [N] (for Next), then [Enter].

3.18 To return to the Main Menu for Descriptive Search of Hardware Data, press [E] (for Exit), then [Enter]. This takes you back to the Ad Hoc Event Aggregation Screen. Again, press [E] (for Exit), then [Enter]. This takes you back to the search buffer options (Figure A-26). The highlighted bar will already be on "Main Search Menu," so press [Enter] again to exit to the Main Menu for Descriptive Search of Hardware Data (Figure A-19).

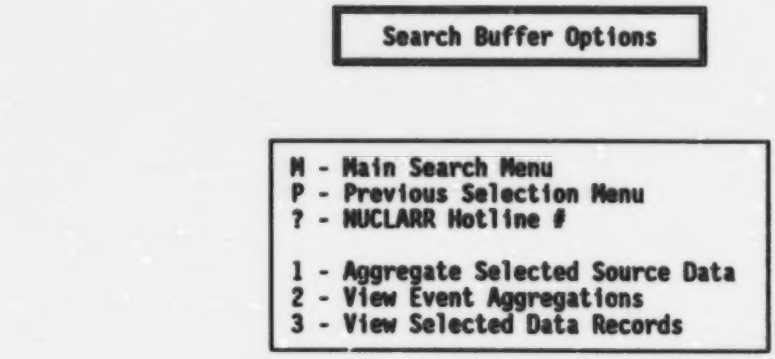

Search Buffer Options
M - Main Search Menu
P - Previous Selection Menu
? - NUCLARR Hotline #
1 - Aggregate Selected Source Data
2 - View Event Aggregations
3 - View Selected Data Records

Figure A-26. NUCLARR Search Buffer Options menu.

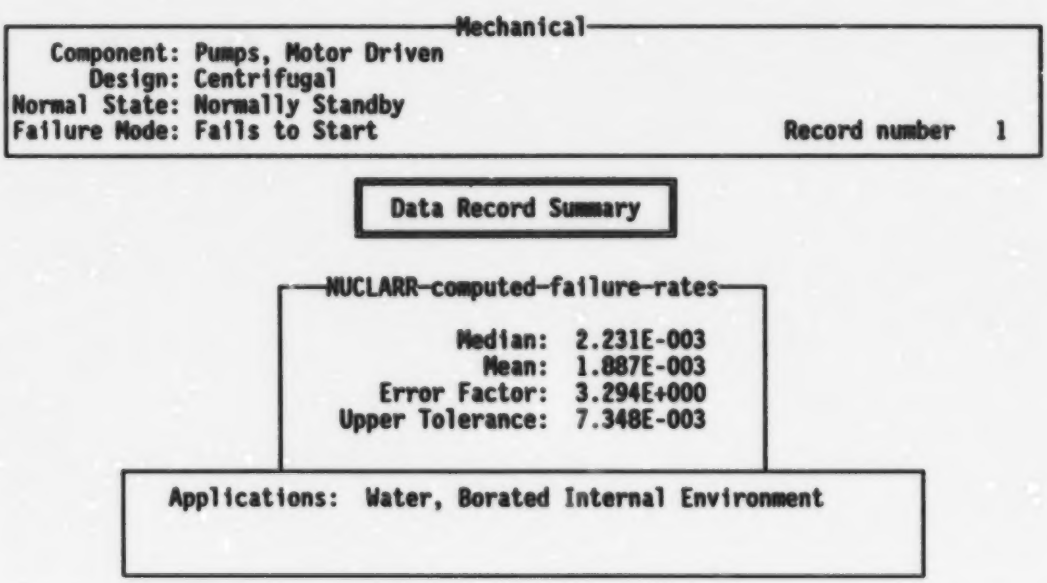


Figure A-27. NUCLARR Data Record Summary.

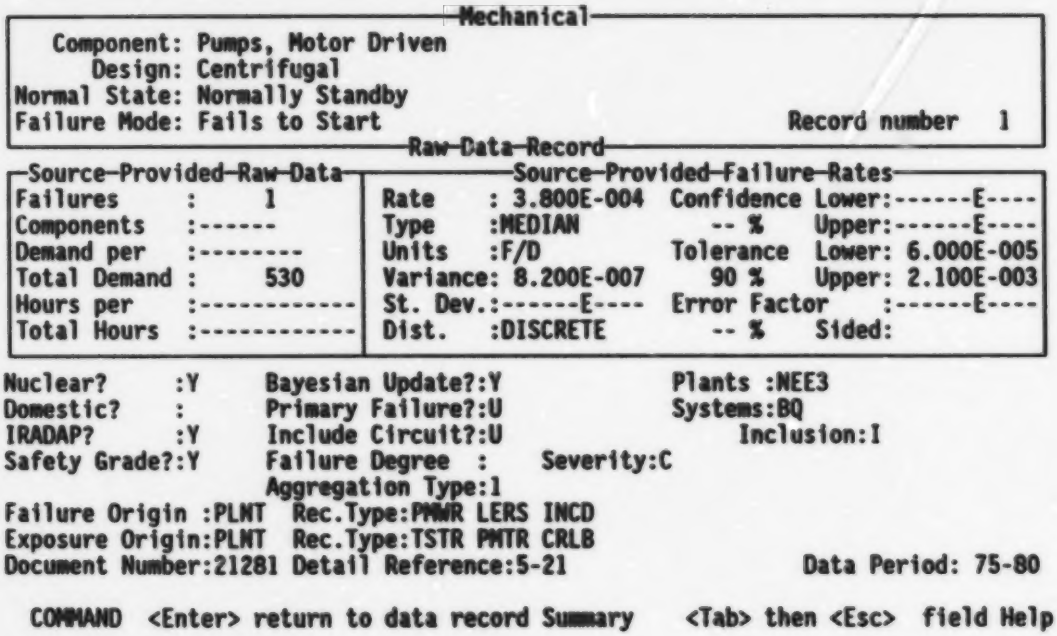


Figure A-28. NUCLARR Raw Data Record screen.

Step	Description

3.19 If you wish, you can obtain a printed copy of the report by selecting Option 6, "Report on Located Data Records," from the Main Menu for Descriptive Search of Hardware Data. This will call up the Summary Report Output Mode Selection screen (Figure A-29).

3.20 Type [R] (for Report on selected records). The cursor will now be a highlighted bar next to Output Mode. Type [PRN], then press [Enter].

3.21 The Summary Report Output Mode screen will now have an "E" (for Exit) placed in the command box. Press [Enter]. This will return you to the Hardware Descriptive Search Main Menu. Select Option E, "Exit from Descriptive Search Program," and press [Enter]. A message will appear, telling you that the located records have not been saved. If you want to save them to a file, move the highlighted bar to Option 9, "Save Located Data Records to a File," and press [Enter].

3.22 Type [M] (for Move records). The cursor will become a highlighted bar next to "To File." Type [EXAMP3], then press [Enter]. The retrieved data have now been saved.

3.23 To continue with the exit procedure, highlight "E - Exit from Descriptive Search Program" and then press [Enter]. You are now ready to do Example 4.

Exercise 4: Locate Component Failure Data by Ad Hoc Search

In this scenario, imagine that you are reviewing a number of event sequences which have been submitted to you for comment. Circuit breaker failures frequently occur in the event sequences and play a critical role in leading to the top level event. Since they are

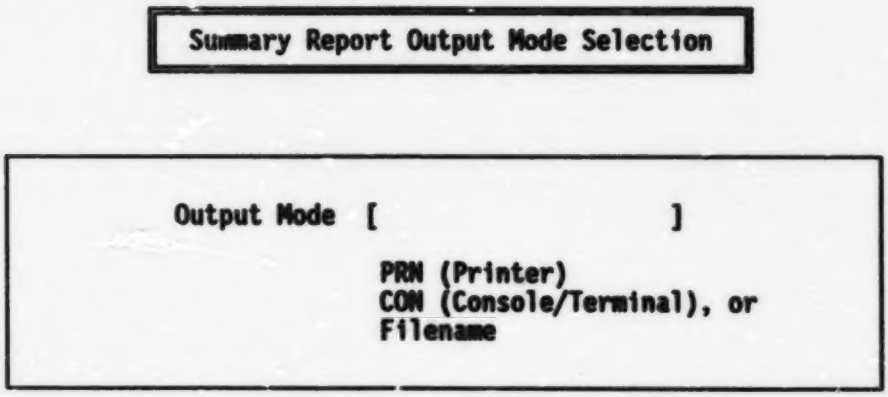

Summary Report Output Mode Selection
Output Mode [ ]
PRN (Printer)
CON (Console/Terminal), or
Filename
COMMAND [ ] Exit Report on selected data records ? NUCLARR Hotline #

Figure A-29. NUCLARR Summary Report Output Mode Selection.

critical failures in the event sequence, and because of their frequent occurrence, you decide to evaluate whether the reported value used for these probabilities is similar to the reported values in NUCLARR. The failure postulated is that a circuit breaker which is normally open fails to close. The ac voltage is unknown, and the design of the circuit breaker is also unknown, although it is likely that it is solid-state or vacuum-controlled.

Instructions: Determine the probability that the circuit breaker fails to close

Step	Description
4.1	At the Main Retrieve Menu for Hardware Component Failure Data (Figure A-18), select option 2, "Locate Data Records by Ad Hoc Search."
4.2	The next menu (Figure A-30) is the Main Menu for Ad Hoc Search of Hardware Data. At this menu, select option 2, "Ad Hoc Search."
4.3	The next menu (Figure A-31) is used to "Locate Data Records." Before we begin the record search, make sure that the search buffer has been cleared. In the box labeled "Records Located" in the upper right, verify that the total is 0 (no records in the buffer). If it is not, move to the command box by pressing the [Home] key. Next press [C] and [Enter]. The search buffer is now cleared.
4.4	After making sure that the search buffer has been cleared, position the cursor in the box for "Component." Next, press the [Esc] key on your keyboard. This calls up a HELP menu. When this menu appears on your display (Figure A-32), position the cursor to highlight "Electrical/Instrumentation" and press [Return] to see the associated codes.

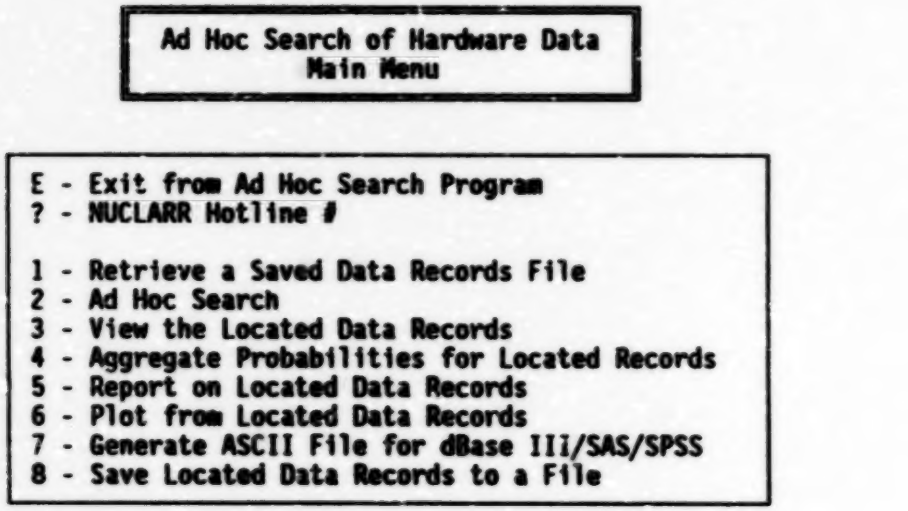

Ad Hoc Search of Hardware Data
Main Menu
E - Exit from Ad Hoc Search Program
? - NUCLARR Hotline #
1 - Retrieve a Saved Data Records File
2 - Ad Hoc Search
3 - View the Located Data Records
4 - Aggregate Probabilities for Located Records
5 - Report on Located Data Records
6 - Plot from Located Data Records
7 - Generate ASCII File for dBase III/SAS/SPSS
8 - Save Located Data Records to a File

Figure A-30. NUCLARR Main Menu of Ad Hoc Search of Hardware Data.

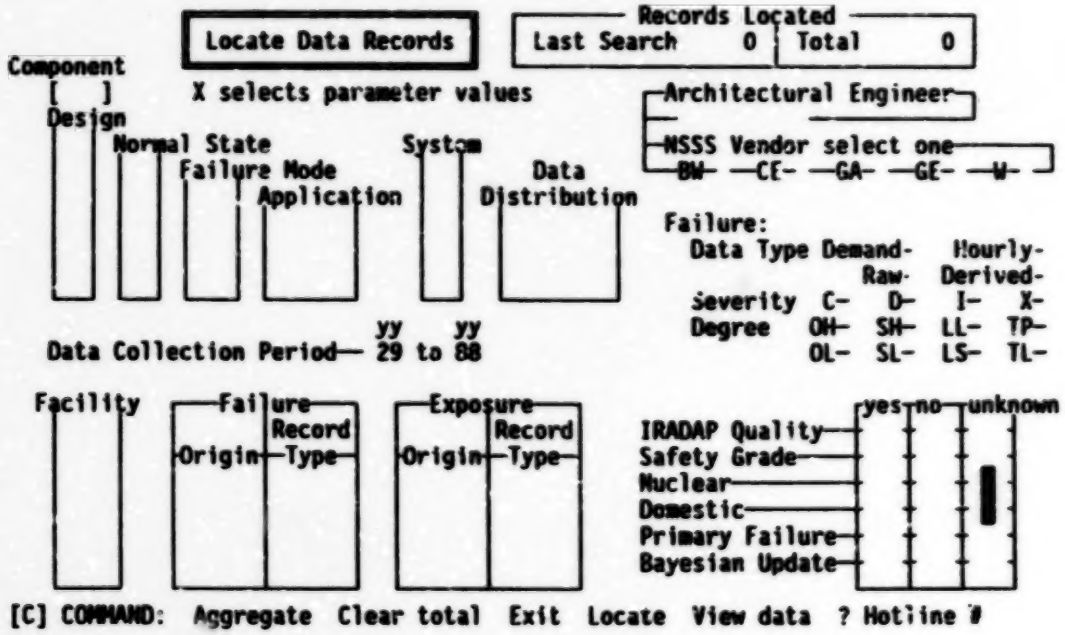


Figure A-31. NUCLARR Locate Data Records screen.

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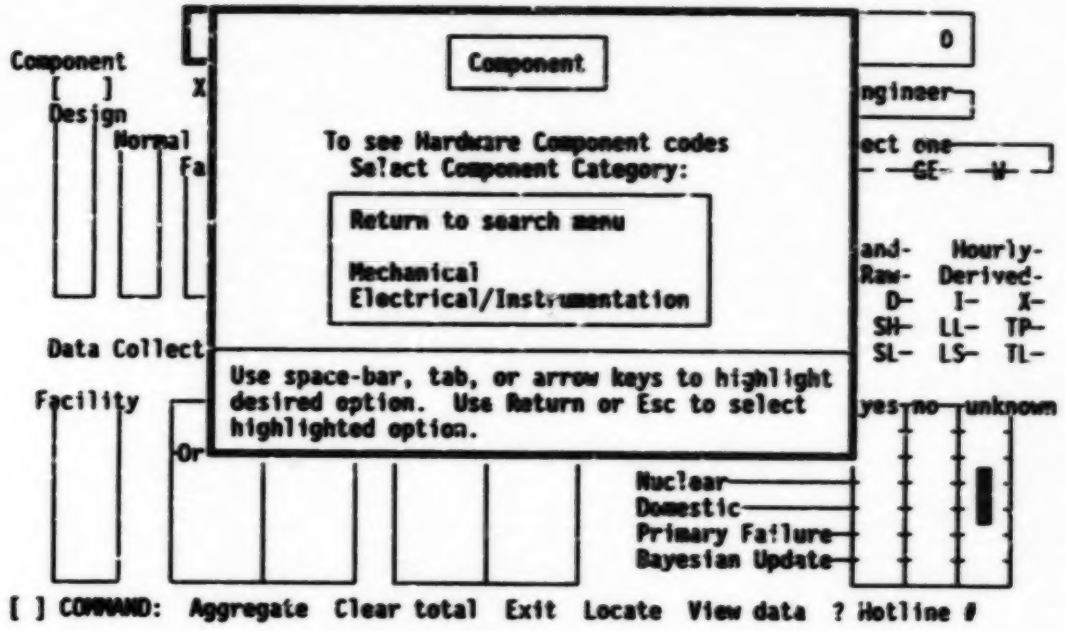

Figure A-32. NUCLARR Select Component Category screen.

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Step	Description

4.5 Another menu (Figure A-33) will pop up over the Ad Hoc Search menu to show the "Available Electrical/Instrumentation Hardware Component Codes." From this list, highlight "Circuit Breakers, Power", Code CBP, and press the [Esc] key to enter the CBP code into the component box. NOTE: At this point, you may terminate the search. Selection of additional parameters is not mandatory. The option to select more parameters, however, will focus your search.

4.6 Next, move your cursor to the "Design" field. In this field, we want to tell NUCLARR to search through records for Unknown (code XX), Solid State (code SS), and Vacuum Controlled (code VC) circuit breaker designs. Since there are three values of interest and the codes are specified, you will not use the pop-up HELP menu to select these values. Instead, enter XX on the first line of the "Design" list, SS on the second line, and VC on the third line.

4.7 Move the cursor next to the column for "Normal State" and press the [Esc] key. The menu for "Available Normal State Codes" will appear on your display (Figure A-34). Since the circuit breaker(s) are normally in the open position, highlight the "Normally Open" option and press [Enter]. NUCLARR puts the letters "NO" (for normally open) in this column.

4.8 Next, move your cursor to the field to select the "Failure Mode." Press the [Esc] key, and the start of the list of "Available Failure Mode Codes" will be presented on your display (Figure A-35). In this case, the circuit breaker fails to close, so highlight "Fails to Close" (failure code FTC). Press [Enter] and NUCLARR will enter FTC in the "Failure Mode" field.

AVAILABLE ELECTRICAL/INSTRUMENTATION HARDWARE COMPONENT CODES

Code	Component Description
ABT	Automatic Transfer Switches
AMP	Amplifiers
ANN	Annunciators
BAT	Batteries
BCH	Charger, Battery
CBM	Circuit Breakers, Molder Case
CBP	Circuit Breakers, Power
CHA	Channel (Series of Instrumenation Components)
CND	Conductors
COM	Computation Modules
CPU	Computers
CRC	Circuit, Control
CTE	Controllers/Regulators, Non-mechanical
DSP	Displays
EFI	Electrical Function Items
EPP	Electrical Piece Parts
FUS	Fuse
GND	Generator, with Diesel Engine Driver
GNG	Generator, with Gasoline Engine Driver
GNH	Generator, with Hydro Turbine Driver

—— Use PgUp, PgDn, and arrow keys to display codes and position cursor. ——
Esc - selects highlighted code for use on entry form. Enter - to prior menu

Figure A-33. NUCLARR Available Electrical/Instrumentation Hardware Component Codes menu.

AVAILABLE NORMAL STATE CODES

Code	Description
NA	Normally Alternating
NC	Normally Closed
ND	Normally De-energized
NE	Normally Energized
NL	Normally Locked-out
NO	Normally Open
NR	Normally Running
NS	Normally Standby

———— Use arrow keys, tab keys, or space bar to position cursor. ————
Esc or Enter - selects highlighted code for use on entry form.

Figure A-34. NUCLARR Available Normal State Codes menu.

AVAILABLE FAILURE MODE CODES

Code	Description
F	Fails to Operate Group
FTO	Fails to Operate
FTS	Fails to Start
FTR	Fails to Run
FTP	Fails to Open
FTC	Fails to Close
FTE	Fails to Energize
FTD	Fails to De-energize
FTT	Fails to Transfer Electrically
S	Spurious Operation Group
SO	Spurious Operation
SS	Spurious Start
SP	Spurious Open (Transfer Open)
SC	Spurious Close (Transfer Closed)
SE	Spurious Energize
SD	Spurious De-energize
ST	Spurious Transfer Electrically
L	Leakage Group
LK	Leakage
LE	External Leakage/Rupture

Use arrow keys, tab keys, or space bar to position cursor.
Esc or Enter - selects highlighted code for use on entry form.

Figure A-35. NUCLARR Failure Mode Codes menu.

Step	Description
4.9	Move your cursor to the "Application" field adjacent to the failure mode field. Press the down arrow key once, then press the right arrow key three times. Again, press [Esc]. This will bring up the "Application" menu (Figure A-36). Highlight the option to "Proceed to Application List" and press [Enter].
4.10	The next menu (Figure A-37) displays the "Available Hardware Component Application Codes." The code for unknown voltage is not on this display. However, you can view additional application codes by pressing the [PgDn] key to the right of your keyboard. After you press the [PgDn] key once, you will see "Voltage level unknown - AC" listed. Select this option and press [Enter]. NUCLARR will put the code "VTAXX" in the Application column for you. Then you will be at the Application menu again. Highlight "Return to Search Menu."
4.11	You have now specified the criteria for the ad hoc data search. If the cursor is not already in the command box, move it there by pressing the [Home] key. To begin the data base search, press the letter [L] (for Locate), followed by the [Enter] key. NUCLARR will respond by posting the following message at the bottom of the display: Locate processing has begun ... please standby. When NUCLARR has completed its search of the data base, the number of records will be displayed in the "Records Located" box in the upper right corner of the display.
4.12	Before you exit from the "Locate Data Records" menu, you should aggregate the data records. To do this enter [A] (for Aggregate) in the command box, followed by [Enter]. [Note that this can also be done later from the main menu, if you desire.]
4.13	After NUCLARR has aggregated the data records, exit from this menu. Press the [E] key, then [Enter]. The Main Menu for the Ad Hoc Search of Hardware Data (Figure A-30) will be presented next.

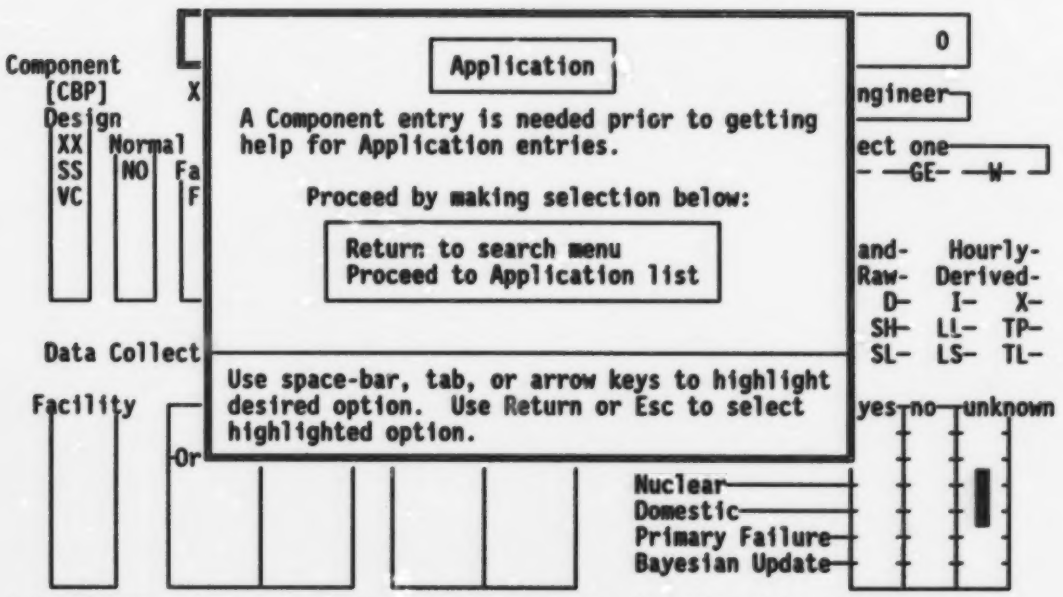

Figure A-36. NUCLARR Select Application screen.

AVAILABLE HARDWARE COMPONENT APPLICATION CODES
FOR COMPONENT
CBP

Code	Application Description
VTAC	VOLTAGE LEVEL APPLICATIONS - AC
VTACAA	< 125 VAC (single voltage)
VTACAB	< 249 VAC (voltage range)
VTACAC	< 599 VAC (voltage range)
VTACBB	125 - 249 VAC (single voltage)
VTACBC	125 - 599 VAC (voltage range)
VTACCC	250 - 599 VAC (single voltage)
VTACCD	250 VAC - 4.74 kVAC (voltage range)
VTACDD	600 VAC - 4.74 kVAC (single voltage)
VTACDE	600 VAC - 8.24 kVAC (voltage range)
VTACDI	> 600 VAC (voltage range)
VTACEE	4.75 - 8.24 kVAC (single voltage)
VTACEF	4.75 - 14.9 kVAC (voltage range)
VTACFF	8.25 - 14.9 kVAC (single voltage)
VTACFG	8.25 - 72.4 kVAC (voltage range)
VTACGG	15.0 - 72.4 kVAC (single voltage)
VTACGH	15.0 - 168 kVAC (voltage range)
VTACHH	72.5 - 168 kVAC (single voltage)

—— Use PgUp, PgDn, and arrow keys to display codes and position cursor. ——
Esc - selects highlighted code for use on entry form. Enter - to prior menu

Figure A-37. NUCLARR Available Hardware Component Application Codes menu.

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Step	Description
4.14	At the main menu, select option 5, "Report on Located Data Records, then press [Enter].
4.15	NUCLARR will present you with a menu that you can use to select where you want the report sent. Type [R] (for Report on Selected Data Records). The highlighted bar will now move opposite "Output Mode." Type the word [CON] and press [Enter] to have NUCLARR present the report on your display.
4.16	The summary of component failure data records will be presented on your display (Figure A-38). When prompted, press the [Enter] key to continue viewing data on your display. The data provide you with the probability of circuit breaker failure which you can use in your review of the event sequences.
4.17	To return to the Main Menu for the Ad Hoc Search of Hardware Data, type [E], then press [Enter]. You may now do another search through hardware data or return to the Main Retrieve Menu.
4.18	To return to the Main Retrieve Menu, move the highlighted bar to "Exit from Ad Hoc Search Program," then press [Enter]. If you do not want to save the previously located data records, press [Enter] again. You may now locate more records or return to the NUCLARR Main Menu.
4.19	To return to the NUCLARR Main Menu, move the highlighted bar to option E, "Exit from Hardware Retrieve Program," and press [Enter]. You may now enter the HEP Retrieve Program, read the HEP or Hardware Aggregation Help Files, or quit the NUCLARR Retrieve Program.
4.20	To return to DOS, press [Q] (for Quit the NUCLARR system), then press [Enter].

SUMMARY-REPORT-ON-SELECTED-DATA-RECORDS

Component: Circuit Breakers, Power
Failure Grouping: Fails to Operate Group 2 Records

Demand-Aggregations	Hourly-Aggregations
Median: 1.774E-003	Median: ------E----
Upper Bound: 3.055E-003	Upper Bound: ------E----

Press <Enter> to continue or <E> to End

Figure A-38. NUCLARR Summary Report on Selected Data Records screen.

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The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal micro-computer. NUCLARR can be used by the end user to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment activities.

The NUCLARR system is documented in a five-volume series of reports. Volume IV: User's Guide is presented in three parts. Part 1: Overview of NUCLARR Data Retrieval, provides an introductory overview to the system's capabilities and procedures for data retrieval. Part 2: Guide to Operations contains the instructions and basic procedures for using the NUCLARR software. Part 3: NUCLARR System Description provides an in-depth discussion of the design characteristics and special features of the NUCLARR software.

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